BIRD *AVIAN*

OPERATOR/SERVICE MANUAL

(DPSC VERSION)

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BIRD AVIAN PORTABLE VENTILATOR (DPSC VERSION)

TABLE OF CONTENTS

SECTION 1.0
Product Information

1.1 Introduction 1
1.2 Intended Use 1
1.3 Product Specifications 1
1.3.1 Electrical 1
1.3.2 Alarms 2
1.3.3 Controls 2
1.3.4 Monitors/Indicators 2
1.3.5 Pneumatic 3
1.3.6 Physical Characteristics 3
1.4 Packing List 3
1.5 Product Warranty 3

SECTION 2.0
Warnings, Cautions and Notes

2.1 Introduction 5
2.2 Definitions 5
2.3 Warnings 5
2.4 Cautions 7

SECTION 3.0
Description of Controls, Alarms and Displays

3.1 Introduction 9
3.2 Controls 9
3.2.1 Mode Control 9
3.2.2 Inspiratory Time/Tidal Volume 10
3.2.3 Breath Rate Control 10
3.2.4 Flow 10
3.2.5 Assist Sensitivity 10
3.2.6 Manual PEEP Reference 10
3.2.7 Pressure Relief 11
3.2.8 Sigh ON/OFF 11
3.2.9 Manual Breath 11
3.2.10 Display Controls 11
3.3 Alarms 11
3.3.1 High Peak Pressure 11
3.3.2 Low Peak Pressure 12
3.3.3 Alarm Silence/Reset 12
3.3.4 I:E RATIO ALARM 13
3.3.5 Apnea Alarm 13
3.3.6 Disconnect Alarm 13
3.3.7 Ventilator Inoperative Alarm 13

3.3.8 External Power Low/Fail 13
3.3.9 Battery Low/Fail 14
3.3.10 PEEP Not Set 14
3.3.11 Transducer Calibration 14
3.4 Monitors 14
3.4.1 Power On 14
3.4.2 External Power 14
3.4.3 Airway Pressure Monitor 15
3.4.4 Monitor Display 15
3.4.5 Peak Inspiratory Pressure (PIP) 15
3.4.6 Mean Airway Pressure (MAP) 15
3.4.7 Airway Pressure (Paw) 16
3.4.8 Limits 16
3.4.8.1 Breath Rate/Inspiratory Time 16
3.4.8.2 Tidal Volume/Flow/Breath Rate 16
Figure 3.1 Front Panel Illustration 17
Table 3.1 Front Panel Illustration Reference 18
Figure 3.2 Pneumatic and External Power Connections Illustration 19
Figure 3.3 Patient Valve Illustration 20

SECTION 4.0
Operating Instructions

4.1 Introduction 21
4.2 Assembly Instructions 21
4.3 Performance Check 22
4.3.1 Preparation 22
4.3.2 Internal Self Test 22
4.3.3 Test Settings 22
4.3.4 Testing 23
4.4 Start-up Instructions 24
4.4.1 Ventilator Setup 24
4.4.2 Description of Ventilator Modes 25
4.4.2.1 Control Mode 25
4.4.2.2 Assist/Control 25
4.4.2.3 SIMV 25
4.4.2.4 CAL Mode 25
4.4.2.5 Off Setting 26
4.5 Apnea Backup Ventilation 26
4.6 Clinical Operation of Controls 26
4.6.1 Mode 26
4.6.2 Inspiratory Time/Tidal Volume 27
4.6.3 Breath Rate 27
4.6.4 Flow 27
4.6.5 Sensitivity 27
4.6.6 PEEP/CPAP 27
4.6.7 Manual PEEP Reference 27
4.6.8 Sigh ON/OFF 28
4.6.9 Manual Breath 28
4.6.10 Pressure Relief Valve 28
4.7 Clinical Operation of Alarms 28
4.7.1 High Peak Pressure 28
4.7.2 Low Peak Pressure 28
4.8 Clinical Operation of Ventilation Modes 29
4.8.1 Control Mode 29

4.8.2 Assist/Control 29
4.8.3 SIMV 29

SECTION 5.0
Clinical Troubleshooting

5.1 Introduction 31
5.2 Troubleshooting Chart 31

SECTION 6.0
Cleaning and Sterilization

6.1 Introduction 33
6.2 Ventilator 33
6.3 Patient Valve Assembly 33
6.4 Breathing Circuit 33
6.5 PEEP Valve 34

SECTION 7.0
Overview of System Operation

7.1 Introduction 35
7.1.1 Pneumatic Schematic 35
7.2 Theory of Operation 36
7.2.1 Gas Inlet and Pressure Conditioning 36
7.2.2 Main Flow Control System 36
7.2.3 Exhalation Valve and Control System 36
7.2.4 Demand System 36
7.2.5 Pressure Relief Function/Anti-Suffocation Valve 36
7.2.6 Airway Pressure Transducer 37
7.1.2 Electrical Block Diagram 37
7.3 Electronic Circuit Descriptions 37
7.3.1 Power Supply Board 37
7.3.2 Main Printed Circuit Board 38
7.3.3 Display Board 39

SECTION 8.0
Maintenance and Service

8.1 Introduction 41
8.2 Recommended Tools and Test Equipment 41
8.2.1 Special Tools and Test Equipment 41
8.2.2 Common Tools 42
8.3 Preventive Maintenance 42
8.3.1 Recommended Maintenance Schedule 42
8.3.2 Preventive Maintenance 42
8.4 Battery Care 43
8.4.1 Battery Replacement 43
Figure 8.4.1 Battery Compartment 44
8.5 Test Procedures 45
8.5.1 Avian Test Settings 45
8.5.2 Standard Test Diagram 46

8.5.4 Testing 48
8.6 Technical Troubleshooting Chart 52
8.7 Disassembly - Reassembly Instructions 54
8.7.1 Avian Case 54
8.7.2 Power Supply Printed Circuit Board 55
8.7.3 EPROM Replacement 55
8.7.4 Pneumatic Manifold Assembly 55
8.7.5 Main Printed Circuit Board 55
8.7.6 Display Printed Circuit Board 56
8.7.7 Demand or Flow Solenoid Valve Replacement 56
8.7.8 Overlay/Switch Panel (Keypad) Replacement 56
8.8 Pressure Transducer Calibration 57
8.9 Error Codes 57
8.10 Technical Assistance 58

SECTION 9.0
Schematics and Illustrated Parts Listings

9.1 Introduction 59
9.2 Parts and Accessories Ordering Information 59
9.3 List of Accessories 60
Figure 9.3.1 Accessories Illustration 61
9.4 Replacement Parts List 62
Figure 9.4.1 Illustrated Parts Drawing (Exploded View) 63
Figure 9.5 Main Printed Circuit Board Illustration (Part Number 50370) 65
Figure 9.6 Display Printed Circuit Board Illustration (Part Number 50380) 66
Figure 9.7 Power Supply Printed Circuit Board Illustration (Part Number 50390) ..67
Figure 9.5.1 Main Printed Circuit Board Schematic, Sheet 1 of 6 69
Figure 9.5.2 Main Printed Circuit Board Schematic, Sheet 2 of 6 71
Figure 9.5.3 Main Printed Circuit Board Schematic, Sheet 3 of 6 73
Figure 9.5.4 Main Printed Circuit Board Schematic, Sheet 4 of 6 75
Figure 9.5.5 Main Printed Circuit Board Schematic, Sheet 5 of 6 77
Figure 9.5.6 Main Printed Circuit Board Schematic, Sheet 6 of 6 80
Figure 9.6.1 Display Printed Circuit Board Schematic 81
Figure 9.7.1 Power Supply Printed Circuit Board Schematic 83

SECTION 1.0
Product Information

1.1 Introduction

The Bird Avian Portable Ventilator is a time or volume cycled, pressure limited ventilator, which can support a variety of ventilation modes. The modes are Control, Assist/Control and SIMV. The ventilator's compact, simple design is easy to use and extremely durable.

The Bird Avian Portable Ventilator is microprocessor controlled. The ventilator provides the operator with a variety of controls and comprehensive alarms that include the following items:

- Automatic apnea backup ventilation
- 15-100 cmH_2O peak inspiratory pressure
- 0-20 cmH_2O PEEP
- Audio/visual alarms for high/low peak pressures, apnea, inverse I:E ratio and patient circuit disconnect.
- Proximal airway pressure monitoring
- 0-100 LPM peak flow
- Breath rate from 0-150 BPM

1.2 Intended Use

The Bird Avian Portable Ventilator is suitable for use in clinical, field hospital, aeromedical, and transport settings. Its compact, durable exterior and lightweight design make the Avian exceptionally easy to transport and store.

This ventilator is a self-powered unit using its own internal, rechargeable battery; additionally, each Bird Avian is packaged with a 115/230 VAC switch selectable AC power supply and a 12 VDC power cable to allow for connection to external 11-30 VDC power sources.

The Bird Avian operates from gas sources capable of delivering between 40 - 60 PSIG, including compressed gas cylinders (air, oxygen or air/oxygen mixtures), medical grade air compressors or on-board aircraft gas sources. The gas input of the Bird Avian can also accept blended gas mixtures from a gas blender.

1.3 Product Specifications

1.3.1 Electrical

ELECTRICAL	VOLTAGE/HZ
External DC Power	External Input Voltage 11 to 30 VDC (Positive or Negative Polarity)
Internal Battery	Rechargeable (11 Hours minimum operation on full charge)
External Power Adapter (Switch selectable input)	100 - 125 VAC, 50 - 400 HZ 220 - 250 VAC, 50 - 400 HZ

1.3.2 Alarms

ALARMS	DESCRIPTION/LIMITS
High Peak Pressure	15 to 100 cmH_2O (100cmH_2O is equivalent to Off)
Low Peak Pressure	OFF, 2 to 50 cmH_2O
I:E Ratio (inverse)	Audio/Visual
Apnea	Audio/Visual (automatic - 20 sec.)
External Power - Low & Fail	Audio/Visual
Disconnect	Audio/Visual
PEEP Not Set	Audio/Visual
Battery Low/Fail	Audio/Visual
Alarm Silence/Reset	Variable Duration (Depending on the alarm) Single Touch Button

1.3.3 Controls

CONTROLS	DESCRIPTIONS
Modes	Control, Assist-Control, SIMV and Off
Breath Rate	0 to 150 bpm
Flow	0 to 100 lpm
Inspiratory Time	0.1 to 3.0 seconds
Tidal Volume	50 to 2000 ml
Assist Sensitivity	-2 to -8 cmH_2O
Manual Breath	Touch button activated.
PEEP/CPAP	0 to 20 cmH_2O (with removable PEEP valve)
Sigh	On/Off 1 sigh/100 breaths or 7 minutes Inspiratory Time or Tidal Volume 1.5 X setting,(3.0 second max) High Pressure Limit 1.5 X setting (100 cmH_2O max)
Manual (PEEP) Reference Set	0 to 20 cmH_2O
Pressure Relief	10 to 100 cmH_2O

1.3.4 Monitors/Indicators

MONITORS/INDICATORS	DESCRIPTION
Green LED	Power On
Yellow LED	External Power
Red LED	PEEP Not Set Apnea Battery (Low/Fail) External Power Failure Vent Inoperative Disconnect
4 Digit 7 Segment LED Display	(M.A.P.)Mean Airway Pressure 0 to 100 cmH_2O (P.I.P.)Peak Inspiratory Pressure 0 to 100 cmH_2O (P_{aw})Airway Pressure 0 to 100 cmH_2O Low Peak Pressure 0 to 50 cmH_2O High Peak Pressure 15 to 100 cmH_2O Assist Sensitivity -2 to -8 cmH_2O Inspiratory Time 0.1 to 3.0 seconds Tidal Volume 50 to 2000 ml Breath Rate 0 to 150 bpm Flow 0 to 100 LPM
LED Bar Graph	Airway Pressure -10 to 100 cmH_2O

1.3.5 Pneumatic

PNEUMATIC	INPUT SOURCE
40 to 60 psig of clean, dry medical grade air, oxygen or air-oxygen mixtures.	Compressed gas cylinders Medical grade air compressors On-board aircraft gas sources Blended gas mixtures from a gas blender

1.3.6 Physical Characteristics

PHYSICAL CHARACTERISTICS	DIMENSIONS - RANGES
Height Width Depth	10 Inches (254 mm) 12 Inches (305 mm) 5 Inches (127 mm)
Weight	11 Pounds (5.0 Kg)
Operating Temperatures	-4°F to 115°F (-20°C to 46° C)
Storage Temperatures	50°F to 80°F (10°C to 27°C)

1.4 Packing List

Quantity	Description
1	Shipping Case
1	Avian Portable Ventilator
1	External AC Power Supply Adapter
1	12 VDC Power Cable
1	Reuseable Patient Exhalation Valve
1	Anti-Suffocation Valve
1	Reuseable PEEP Valve
1	6 ft. length of 15mm Patient Gas Source Supply hose
2	6 ft. lengths of 1/8" tubing
2	Commercial Operating Instructions/Maintenance Manuals

1.5 Product Warranty

The products of Bird Products Corporation (Herein Bird) are warranted to be free from defects in material and workmanship and to meet the published specifications. .

The liability of Bird under this warranty is limited to replacing, repairing or issuing credit, at the discretion of Bird, for the parts that become defective or fail to meet published specifications during the warranty period; Bird will not be liable under this warranty unless (A) Bird is promptly notified in writing by Buyer upon discovery of defects or failure to meet specifications; (B) the defective unit or part is returned to Bird, transportation charges prepaid by Buyer; (C) the defective unit or part is received by Bird for adjustment no later than four weeks following the last day of the warranty period; and (D) Bird's examination of such unit or part shall disclose, to its satisfaction, that such defects or failures have not been caused by misuse, neglect, improper installation, unauthorized repair, alteration or accident.

Any authorization of Bird for repair or alteration by the Buyer must be in writing to prevent voiding warranty.

Bird warranties as herein above set forth shall not be enlarged, diminished or affected by, and no obligation or liability shall arise or grow out of the rendering of technical advice or service by Bird or its agents in connection with Buyer's order of the products furnished hereunder.

- **LIMITATIONS OF LIABILITIES**

In no event shall Bird be liable to Buyer for loss of profits, loss of use, consequential damage or damages of any kind based upon a claim for breach of warranty, other than the purchase price of any defective product covered hereunder.

This warranty does not cover normal maintenance such as cleaning, adjustment or lubrication and updating of equipment or parts. This warranty shall be void and shall not apply if the equipment is used with accessories or parts not manufactured by Bird or authorized for use in writing by Bird, or if the equipment is not maintained in accordance with a prescribed schedule of maintenance.

The warranty stated above shall extend for a period of one year from date of delivery, with the following exceptions:

- Electrical components for remote monitoring of physical variables such as temperature, pressure, oxygen saturation or flow are warranted for ninety (90) days from date of receipt.
- Elastomeric components and other parts or components subject to deterioration over which Bird has not control are warranted for sixty (60) days from date of receipt.
- The foregoing is in lieu of any other warranty, expressed or implied, including, without limitation, any warranty of merchantability, except as to title, and can be amended only in writing by a duly authorized representative of Bird.

SECTION 2.0
Warnings, Cautions and Notes

2.1 Introduction

Before using or servicing the Bird Avian Portable Ventilator, the user should read and understand all warnings and cautions in this manual. When appropriate, warnings and cautions will be repeated at the start of a section or will precede an instructional paragraph.

Notes are not included in this section. Notes will immediately precede instructional paragraphs.

2.2 Definitions

WARNING

These messages advise the operator of conditions that could have an adverse effect on the patient or the operator. These messages will be identified by the warning indicator that precedes this paragraph.

CAUTION

Caution messages are used to identify conditions that could damage the Bird Avian Portable Ventilator or other equipment. These messages will be identified by the caution indicator that precedes this paragraph.

NOTE

Notes are used to draw attention to specific items that will help the operator or technician to better understand the Bird Avian Portable Ventilator. These messages will precede an instructional paragraph. These messages are identified by the note indicator that precedes this paragraph.

2.3 Warnings

WARNING

If the Bird Avian Portable Ventilator fails the Performance Check, do not attempt to operate the ventilator until the performance specifications have been restored and verified.

WARNING

Technical repairs should be accomplished by qualified personnel, trained either by the Bird Products Corporation or their authorized trainers. BIRD PRODUCTS CORPORATION IS NOT RESPONSIBLE FOR UNAUTHORIZED REPAIRS, OR REPAIRS MADE BY UNAUTHORIZED PERSONNEL.

WARNING

Always replace the fuse in the power supply with a fuse of the same voltage and current rating. Failure to do so could result in injury to personnel or severe damage to the Bird Avian Portable Ventilator.

WARNING

Always operate the Bird Avian with clean, dry medical grade gas. Failure to do so can result in contamination of the unit. The contamination of the unit could jeopardize the patient by causing improper operation and/or premature failure of the ventilator.

WARNING

The operation of the Bird Avian audio and visual alarms should be verified daily.

WARNING

The Bird Avian Portable Ventilator is a restricted medical device. It is intended to be operated by qualified medical personnel under the direction of a qualified physician.

WARNING

It is the responsibility of the clinician or user to establish and set the controls and monitor the alarm settings for each patient and mode of operation.

WARNING

Consult a qualified physician when using an air/oxygen blender for proper fractional inspired oxygen (FIO_2) concentrations.

WARNING

Monitor patient oxygen concentrations at or near the proximal airway. Use a calibrated oxygen analyzer to verify the oxygen concentrations.

WARNING

Always replace the fuse in the power supply with a fuse of the same voltage and current rating. Failure to do so could result in injury to personnel or severe damage to the Bird Avian Portable Ventilator.

WARNING

Do not use the ventilator in the presence of flammable anesthetics as an explosion hazard exists.

2.4 Cautions

CAUTION

Do not sterilize the Bird Avian Portable Ventilator. The internal components are not compatible with sterilization methods.

CAUTION

External cleaning and sterilization of the Bird Avian, with agents that include phenols, ammonia chloride, chloride compounds and/or those with a greater than 2% concentration of glutaraldehyde are not recommended. These agents may cause damage to plastic components and/or control panel overlays.

CAUTION

Prolonged storage at high temperatures (above 80°F (27°C)) can result in premature battery failure. Failure to recharge the battery while it is in storage will also cause premature failure of the battery.

CAUTION

Before opening the case of the Bird Avian, place the ventilator Mode Switch in the Off position and disconnect the external power supply from the unit, and remove the battery from the ventilator.

CAUTION

Always follow proper static grounding procedures when removing and replacing the Bird Avian printed circuit boards.

CAUTION

The calibration accuracy of all test equipment used to test and calibrate the Bird Avian should be verified before recalibrating the ventilator.

CAUTION

The correct polarity must be observed when the battery is replaced. The RED connector on the Avian battery cable connects to the [+] battery terminal. The BLACK connector on the Avian battery cable connects to the [-] battery terminal.

CAUTION

Use caution when installing the new EPROM. Pay close attention to pin alignment and pin one (1) location. Be careful not to bend the IC pins when inserting the EPROM or PROM.

CAUTION

To reduce the risk of electric shock, do not remove the battery cover. Refer servicing to qualified service personnel.

SECTION 3.0
Description of Controls, Alarms and Displays

3.1 Introduction

This section describes the operation of the display, controls, and alarms. The explanations refer to the front panel illustration 3.1, and to the pneumatic and external power panel illustration 3.2.

3.2 Controls

3.2.1 Mode Control

The Mode Control selects the desired mode of operation. Item number 12 designates the location of the control on figure 3.1, Front Panel Illustration. There are five (5) position settings, which are described in the following paragraph.

SETTING	FUNCTION
Off	This setting turns the Avian Off. The Vent Inoperative alarm will sound when the Mode switch is placed in the Off position. The alarm can be silenced by pressing the Alarm Silence/Reset button. The internal battery will continue to charge if the External AC Power source is connected to AC power and to the Avian.
CTRL	All parameters of the delivered breath are controlled by the ventilator.
Assist/Control	This mode allows for the delivery of either a Control or an Assist/Control breath. The patient has the ability to augment the breath rate, but not the flow or tidal volume. The patient may initiate an Assist/Control breath if both the following conditions exist: • The ventilator is not currently in inspiration or the minimum exhalation phase, or; • The patient inspiratory effort exceeds the Sensitivity trigger setting.
SIMV	In the SIMV mode, all control parameters are used, with PEEP and Sigh as optional controls. Breaths can be totally patient controlled, or totally machine controlled with varying degrees of ventilator support between spontaneous breaths. The amount of patient or ventilator control is determined by the ventilator control settings.
CAL	CAL mode provides a means for calibrating the airway pressure transducer to correctly read "zero" at ambient pressure. This mode allows the device to compensate for thermal and long term zero drift. Upon entering CAL mode a display test will activate, illuminating specific LED's and allowing the user to verify the operation of membrane switches and associated LED's. A detailed description of the display test is provided in Section 4, Operating Instructions..

3.2.2 Inspiratory Time/Tidal Volume

This control is designated item number 19 on Figure 3.1, Front Panel Illustration. This is a multiplexed control that allows for direct control of Tidal Volume for volume cycled ventilation or Inspiratory Time for time cycled ventilation. Selection of a control mode is made by depressing the **Tidal Vol.**, or the **Insp. Time** buttons. An LED associated with each button will remain illuminated to indicate which control is selected. When the other control is selected, the setting will flash on the monitor display for six (6) seconds to allow the operator to adjust the new setting. The new selection will not take effect until the six (6) second adjustment period has elapsed. These controls are explained in greater detail in Section 4, Operating Instructions.

FUNCTION	RANGE
Inspiratory Time	0.1 to 3.0 Seconds
Tidal Volume	50 to 2000 ml

3.2.3 Breath Rate Control

This control, designated as number 18 on figure 3.1, Front Panel Illustration is used to set the minimum number of ventilator initiated breaths per minute that can be delivered to the patient in the Control, Assist/Control and SIMV modes of ventilation.

FUNCTION	RANGE
Breath Rate	0 to 150 BPM

3.2.4 Flow

This control is designated as item number 22 on Figure 3.1, Front Panel Illustration. It is used to set the maximum flow delivered to the patient during a Control or Assist Control breath that is delivered by the ventilator.

FUNCTION	RANGE
Flow	0 to 100 LPM

3.2.5 Assist Sensitivity

Item number 16 on Figure 3.1, Front Panel Illustration, identifies the Assist Sensitivity control. The control is used to set the trigger level below baseline pressure for initiation of Spontaneous (SIMV) and Assisted breaths. This function is active in Assist/Control and SIMV modes.

FUNCTION	RANGE
Assist Sensitivity	-2 to -8 cmH_2O

3.2.6 Manual PEEP Reference

The **Man. PEEP Ref.** is located on the front panel and is designated as item number 15 on Figure 3.1, Front Panel Illustration. When activated, this control allows the user to manually set the PEEP reference level. This function is explained in detail in Section 4, Operating Instructions.

3.2.7 Pressure Relief

This control is designated as item number 24 on Figure 3.1, Front Panel Illustration. It is used to set the maximum allowable pressure in the patient circuit. The desired level is set by adjusting the control while observing the Airway Pressure Monitor.

FUNCTION	RANGE
Pressure Relief	10 to 100 cmH_2O

3.2.8 Sigh ON/OFF

The Sigh switch is identified as item number 13 on Figure 3.1, Front Panel Illustration. It is used to turn the automatic sigh function ON or OFF. The Sigh breath, once activated, is delivered once in every 100 breaths or every 7 minutes, whichever occurs first, regardless of breath, (including Manual breaths), type. The Sigh breath is a Control breath equal to 1.5 times the current Inspiratory Time setting (limited to a 3 second maximum), or 1.5 times the current Tidal Volume setting (limited to a 2000 ml maximum) and delivered according to the current Flow setting. The breath period and high pressure limit are automatically increased by 1.5 times, not to exceed maximum available settings.

3.2.9 Manual Breath

This control is designated as item number 14 on Figure 3.1, Front Panel Illustration. It is used to deliver a continuous flow of gas in accordance with the current Flow setting. A Manual Breath initiated during the inspiratory or minimum expiratory phase of all breath types is ignored. Additionally, once a Manual Breath is initiated, the Breath Rate timer is reset, ensuring a full exhalation period before the next breath is initiated.

3.2.10 Display Controls

Several "push-to-display" controls are located on the front panel. When depressed, the Display buttons display the selected parameter on the 4-digit, 7-segment, LED display. (Item number 8 on Figure 3.1, Front Panel Illustration) for three (3) seconds. At the end of the three second window, the display will self-blank until another Display control is activated. The controls with the "push to display" functions are the Breath Rate, Inspiratory Time/Tidal Volume, and Assist Sensitivity (PEEP) Reference. The alarm functions which include this feature are the High Pressure Alarm and Low Pressure Alarm.

3.3 Alarms

3.3.1 High Peak Pressure

WARNING

This safety feature is overidden when the Manual Breath control is activated.

NOTE

The High Peak Pressure alarm cannot be set below PEEP +1 cmH_2O.

The control for this alarm is designated by number 10 on Figure 3.1, Front Panel Illustration. This alarm establishes the maximum allowable pressure for all breath types. An alarm violation will occur when airway pressure exceeds the alarm setting. Once violated, the following events take place immediately:

- The audible alarm will sound and the visual indicator is illuminated.
- The ventilator will revert to an exhalation state, where flow is zero and the exhalation valve is opened.
- If patient pressure resets below 26 cmH_2O, normal ventilation will resume. If airway pressure remains above the High Peak Pressure Alarm Limit, ventilation will remain suspended with continuous audible and visual alarms. The patient may breathe spontaneously through the anti-suffocation valve at any time. The value of the alarm setting will be automatically increased by 1.5 times upon delivery of a Sigh breath. The increased value cannot exceed the 100 cmH_2O limit.

Function	Range
Range	15 to 100 cmH_2O (100cmH_2O is equivalent to Off)
Silence	Yes
Silence Interval	30 seconds

3.3.2 Low Peak Pressure

NOTE

This alarm is active for Control and Assist/Control breaths only.

The control for the Low Peak Pressure alarm is designated as item number 7 on Figure 3.1, Front Panel Illustration. The Low Peak Pressure Alarm is activated when airway pressure fails to exceed the alarm setting during the inspiratory phase of a breath. The alarm initiates audible and visual alarm indications.

Function	Range
Range	OFF (Flashing) 2 to 50 cmH_2O
Silence	Yes
Silence Interval	30 seconds

3.3.3 Alarm Silence/Reset

The Silence/Reset button is located on the front panel, as designated by item number 3, Figure 3.1, Front Panel Illustration. This control allows the operator to temporarily disable some audible alarm signals and/or reset any flashing visual alarm indicators. If activated during an alarm condition, the audible portion of the alarm will be silenced and the Silence LED will illuminate throughout the silence interval. The silence interval will be a function of the specific alarm being silenced. Depressing the Alarm Silence/Reset button while the LED is lit will cancel the alarm silence period and reset all alarms.

NOTE

If the Alarm Silence/Reset switch is activated when alarm conditions are not present but visual indicators from previous alarms are present, the visual indicators will reset and the Silence LED will not light. A sixty (60) second silence period cannot be activated unless an audible alarm is present.

3.3.4 I:E RATIO ALARM

This alarm notifies the user when settings of Inspiratory Time or Tidal Volume, Flow and Breath Rate cause inspiratory time to exceed 50% of the total breath period as defined by the Breath Rate control. When this condition occurs, the ventilator flashes IE on the monitor display, limits inspiratory time to 50% of the total breath and sounds an audible alarm. The visual and audible alarms cannot be canceled until the alarm condition is corrected.

3.3.5 Apnea Alarm

The Apnea alarm is located on the front panel, as designated by item number 1, Figure 3.1, Front Panel Illustration. The alarm activates audible and visual alarms when the period between inspiratory starts exceeds 20 seconds. Also initiates Apnea Backup Ventilation (see Section 4, Operating Instructions). This alarm cannot be silenced. Pressing the alarm silence/reset button when the alarm is active will reset the system to normal ventilatory mode.

3.3.6 Disconnect Alarm

The Disconnect alarm is located on the front panel, as designated by item number 1, Figure 3.1, Front Panel Illustration. Activates audible and visual indicators if a positive pressure rise of at least 2 cmH_2O above initial inspiratory pressure is not detected during an inspiration period.

Function	Duration
Silence	Yes
Silence Interval	30 Seconds

3.3.7 Ventilator Inoperative Alarm

The Vent Inoperative LED alarm indicator is located on the front panel. It is designated as item number 1 on Figure 3.1, Front Panel Illustration. This alarm condition causes the ventilator to cease normal gas delivery and allows a non-apneic patient to breath spontaneously from "room" air. Ventilator Inop alarms fall into two (2) categories: recoverable and non-recoverable. If a recoverable condition exists, the ventilator will return to normal operation once the alarm conditions have been returned to normal. The following are recoverable alarm conditions.

- Loss of electrical power caused by interruptions of the external power.
- Mode switch is momentarily set to the Off position.
- Power supply voltages out of specified range.

A non-recoverable Ventilator Inop condition is generally created by a software detection of an out-of-tolerance condition in the ventilator system. A CPU failure alarm is included which activates whenever the CPU fails to successfully complete a self-check at initial power up or detects an operational fault during operation.

The ventilator must be turned Off and the Alarm Silence/Reset button depressed to silence the audible alarm. To prevent recurrence of the alarm, the condition must be corrected prior to returning the ventilator to normal operation. This alarm cannot be silenced until the condition is corrected.

3.3.8 External Power Low/Fail

The LED indicator for this alarm is located on the front panel. Number 1 on Figure 3.1, Front Panel Illustration, shows the location of the LED. This alarm activates when the external power cord is connected to the Avian and the voltage is out of the specified operating range. The ventilator automatically switches to internal battery power under this condition. This alarm can be silenced and will remain

silenced until the internal low battery alarm activates. The Low Battery Alarm will notify the user when the internal battery is near depletion.

Function	Duration
Silence	Yes
Silence Interval	30 Seconds

3.3.9 Battery Low/Fail

The Battery Low/Fail LED alarm indicator is located on the front panel. It is designated as item number 1 on Figure 3.1, Front Panel Illustration. The alarm activates when battery voltage is out of the acceptable operating range or external power is applied and battery voltage has reached a dead cell condition. This alarm can be silenced for five (5) minute intervals.

Function	Duration
Silence	Yes
Silence Interval	Five (5) minutes

3.3.10 PEEP Not Set

The PEEP Not Set LED alarm indicator is located on the front panel. It is designated as item number 1 on Figure 3.1, Front Panel Illustration. The alarm activates when the monitored PEEP value deviates significantly from the manually set PEEP reference level.

Function	Duration
Silence	Yes
Silence Interval	30 Seconds

3.3.11 Transducer Calibration

Activates during system self-test if the zero baseline pressure exceeds ± 1 cmH_2O. The display will alternately flash CAL and FAIL accompanied by an audible alarm. The audible alarm cannot be silenced until the condition is corrected.

If the transducer calibration alarm activates, the unit must be placed in CAL Mode (see Section 4, Operating Instructions) to recalibrate the transducer.

3.4 Monitors

3.4.1 Power On

The Power On LED indicator is located on the front panel. It is designated as item number 25 on Figure 3.1, Front Panel Illustration. The indicator is a green LED that illuminates when the mode switch is in any position other than Off and when sufficient power (internal or external) is present.

3.4.2 External Power

The External Power LED indicator is located on the front panel. It is designated as item number 26 on Figure 3.1, Front Panel Illustration. The indicator is a yellow LED that illuminates when the control module is connected to an active external power source.

3.4.3 Airway Pressure Monitor

The Airway Pressure Monitor is an LED bar graph indicator. It is located on the front panel and is designated item number 11 on Figure 3.1, Front Panel Illustration. It provides a visual display of real time airway pressure by means of a bar graph.

Function	Range
Range	-10 to 100 cmH_2O

3.4.4 Monitor Display

The Monitor Display is a 4 digit, 7 segment LED display. It is located on the front panel and is designated as item number 8 on Figure 3.1, Front Panel Illustration. The display is used to display monitored pressures, precise values of control and alarm settings and calibration information.

When the unit is turned On, the unit monitor will sequentially scroll through current settings for Breath Rate, Inspiratory Time or Tidal Volume, and High and Low Pressure Alarms.

The LED monitor will display the current numeric setting for the following Controls and Alarms:

- Breath Rate
- Sensitivity (PEEP) Reference
- Inspiratory Time
- High Pressure Alarm
- Low Pressure Alarm
- Tidal Volume

The monitor will display the current value for the above functions when the associated Display button is depressed or when the setting is changed. An LED associated with each parameter will illuminate, indicating which parameter is currently being displayed. The display and its associated LED will self-blank after approximately 3 seconds, but can be reactivated by changing a control setting or by depressing a control's associated Display button.

The monitor will also display the current data for the pressure monitoring functions. An associated LED will light to show the current parameter being displayed.

3.4.5 Peak Inspiratory Pressure (PIP)

The PIP button is located on the front panel. It is designated as item number 4 on Figure 3.1, Front Panel Illustration. When the PIP button is depressed, it displays the Peak Inspiratory Pressure for the breath as monitored by the airway pressure line. This applies to all breath types except Spontaneous.

Function	Range
Range	0 to 100 cmH_2O

3.4.6 Mean Airway Pressure (MAP)

The MAP button is located on the front panel. It is designated as item number 2 on Figure 3.1, Front Panel Illustration. When the MAP button is depressed, the monitor displays the Mean Airway Pressure over the entire ventilation cycle based on a 40 second average. The display is updated every 8 seconds.

Function	Range
Range	0 to 100 cmH_2O

3.4.7 Airway Pressure (P_{aw})

The P_{aw} button is located on the front panel. It is designated as item number 5 on Figure 3.1, Front Panel Illustration. When the P_{aw} button is depressed, the monitor displays current airway pressure.

Function	Range
Range	0 to 100 cmH_2O

3.4.8 Limits

Limits are used to ensure that ventilation controls cannot be set to values that would exceed the physical capabilities of the ventilator. This is an automatic function of the ventilator, and cannot be controlled by the user. A control that is being limited shall have its indicator LED flash on for approximately 500 milliseconds. The following controls and combinations of controls can result in one or more controls being limited:

3.4.8.1 Breath Rate/Inspiratory Time

During all modes of ventilation, a minimum exhalation time of 300 milliseconds is required. If the Breath Rate and Inspiratory Time controls are set to a combination of values that mathematically provide an exhalation time shorter than the required minimum, the Inspiratory Time shall be LIMITED to provide a minimum 300 millisecond exhalation time.

3.4.8.2 Tidal Volume/Flow/Breath Rate

During volume modes of ventilation, a minimum exhalation time of 300 milliseconds is maintained. If the Tidal Volume, Flow and Breath Rate controls are set to any combination of values which cause an exhalation time shorter than 300 milliseconds, the Tidal Volume will be LIMITED so that a minimum 300 millisecond exhalation time is provided.

Figure 3.1 Front Panel Illustration

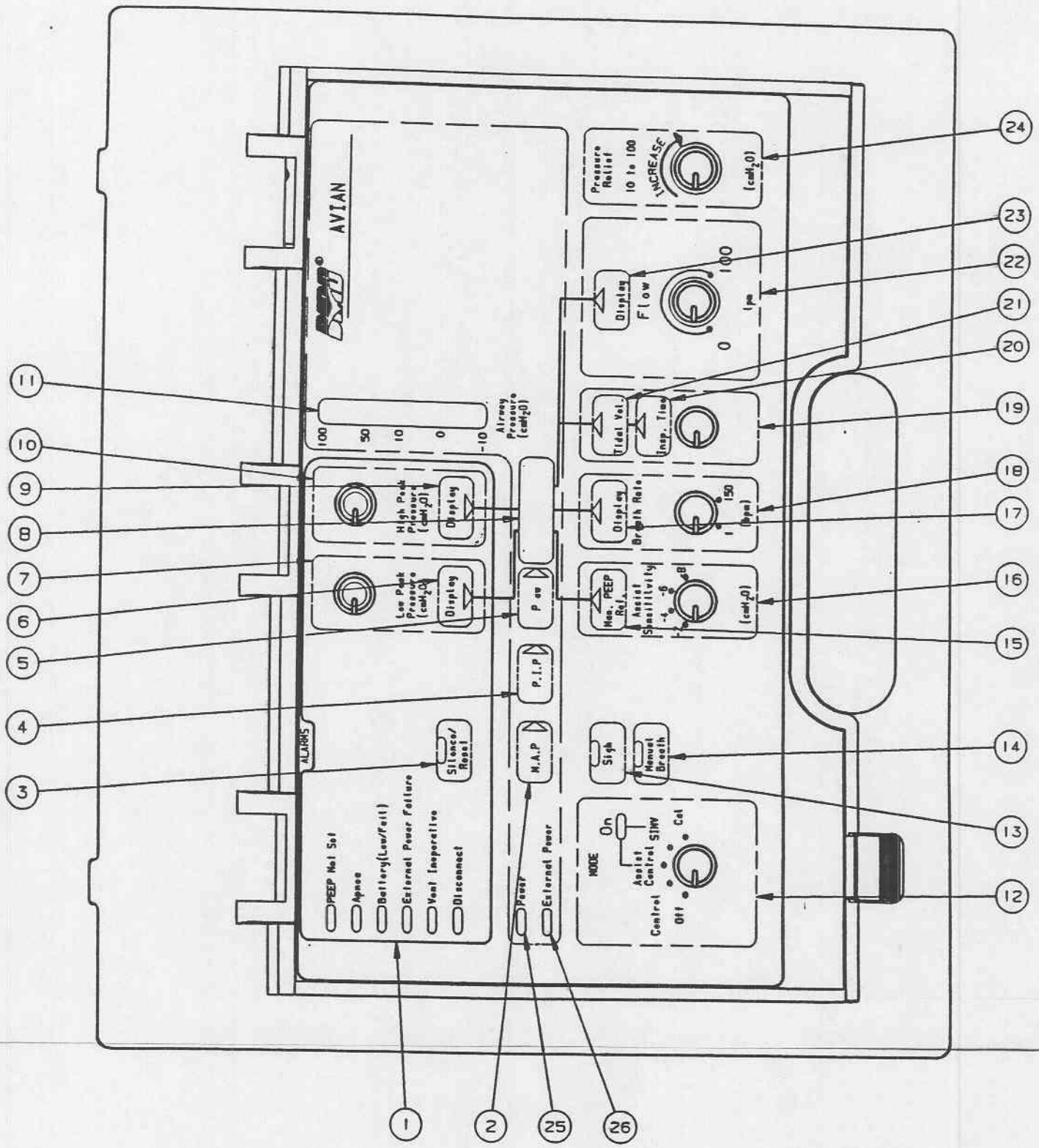
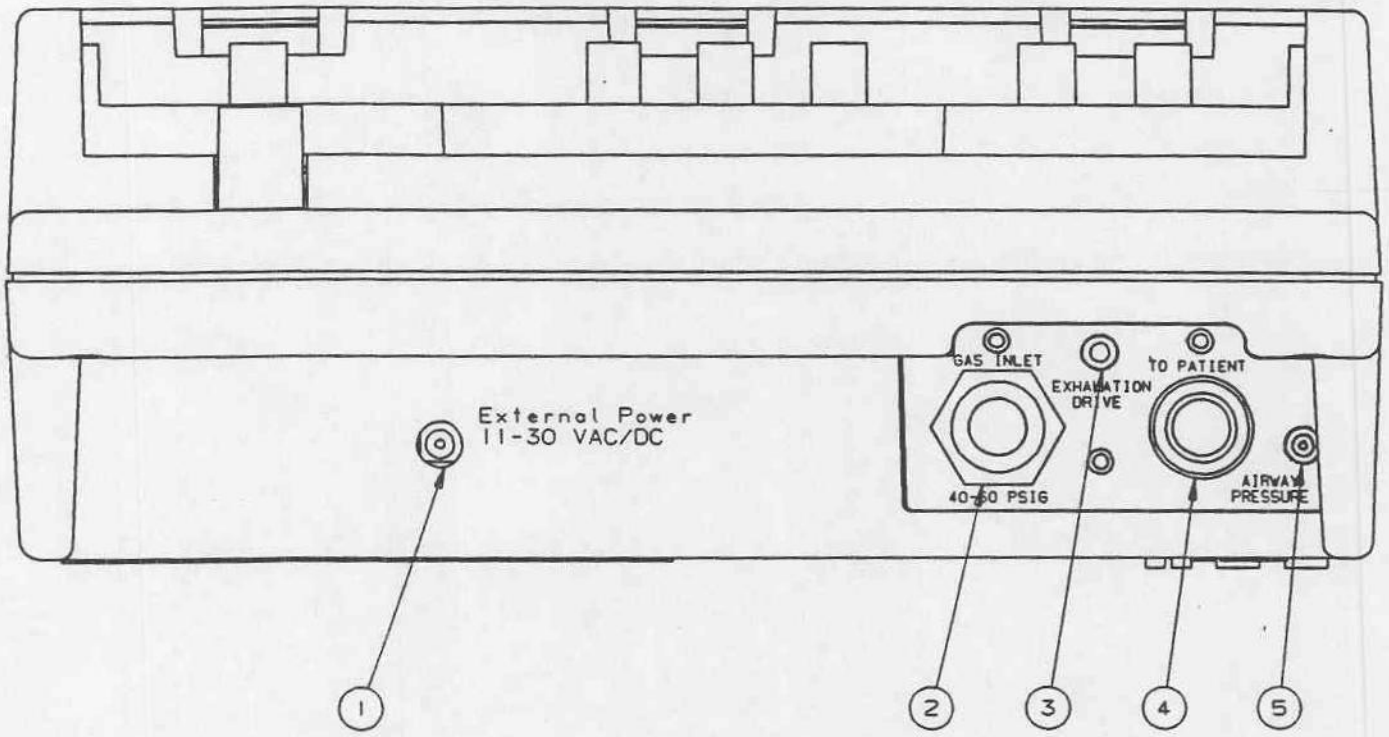


Table 3.1 Front Panel Illustration Reference

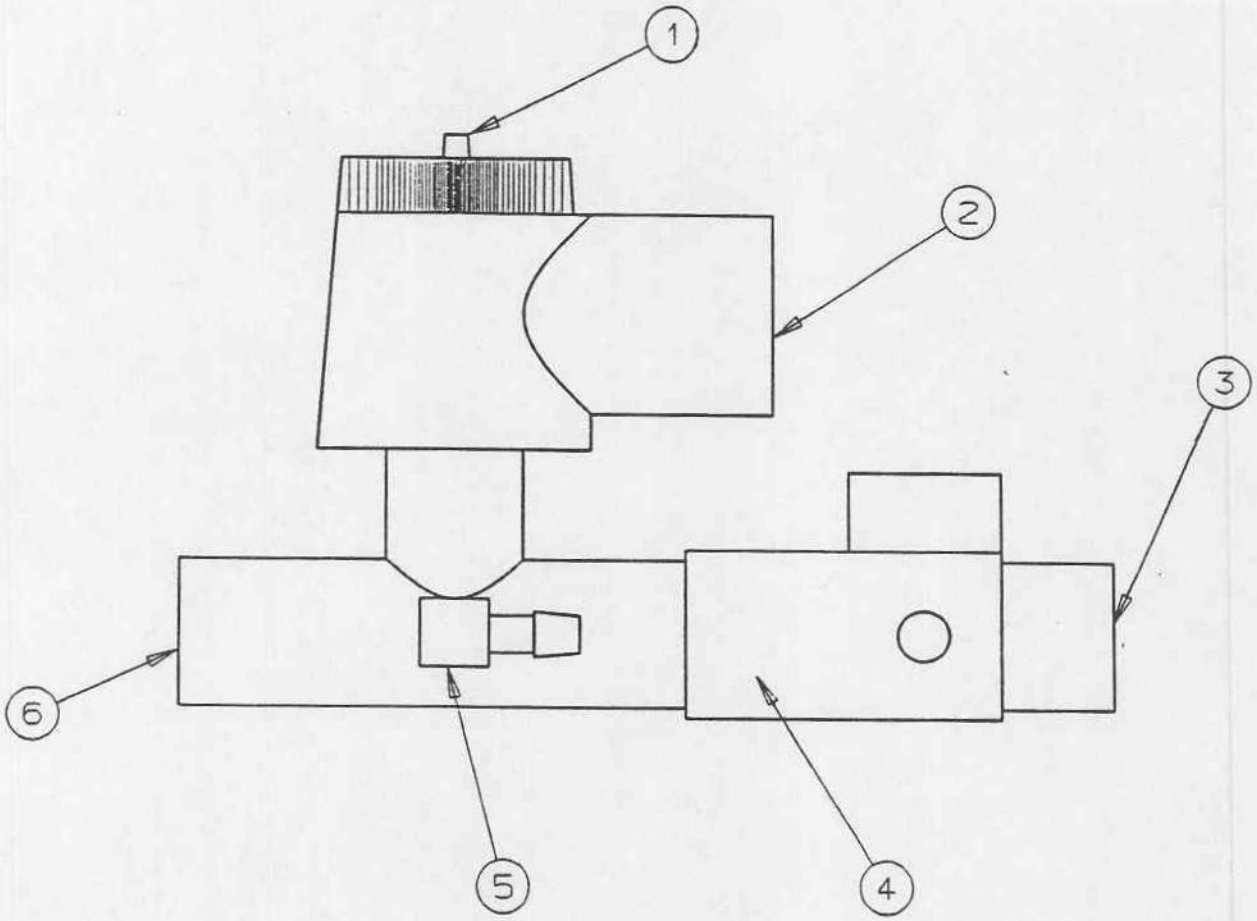
Item Number	Description
1	Alarm Displays, LED (Various)
2	Mean Airway Pressure (M.A.P.) Display Button
3	Alarm Silence/Reset Button
4	Peak Inspiratory Pressure (P.I.P.) Display Button
5	Airway Pressure (P_{aw}) Display Button
6	Low Pressure Alarm Display Button
7	Low Pressure Alarm Control Knob
8	Monitor Display
9	High Pressure Alarm Display Button
10	High Pressure Alarm Control Knob
11	LED Bar Graph Indicator
12	Mode Selection Control Knob
13	Sigh Control Button
14	Manual Breath Control Button
15	Manual PEEP Reference Set Button
16	Assist Sensitivity Control Knob
17	Breath Rate Display Button
18	Breath Rate Control Knob
19	Tidal Volume/Inspiratory Time Control Knob
20	Inspiratory Time Display Button
21	Tidal Volume Display Button
22	Flow Control Knob
23	Flow Display Button
24	Pressure Relief Control Knob
25	Power On Indicator LED
26	External Power Indicator LED

Figure 3.2 Pneumatic and External Power Connections Illustration



Item Number	Description
1	11-30 VAC/DC External Power Input Jack
2	Proximal Pressure Line Port
3	40-60 PSI Gas Supply Inlet
4	Exhalation Valve Line Connection
5	Patient Gas Outlet Port

Figure 3.3 Patient Valve Illustration



Item Number	Description
1	Exhalation Port
2	30mm Exhalation Outlet Port
3	Gas Inlet Port
4	Anti-Suffocation Valve
5	Proximal Pressure Line Port
6	22mm Patient Connection

SECTION 4.0
Operating Instructions

4.1 Introduction

WARNING

Before using the Bird Avian Portable Ventilator, the user should read and understand all warnings and cautions in Section 2.0 of this manual.

4.2 Assembly Instructions

Remove the unit from the shipping container and check to ensure that there is no visible damage to the unit.

Connect the gas supply to the GAS INLET port (item number 3 on Figure 3.2, Pneumatic and External Power Panel Illustration) with the appropriate high pressure hose. If using a Bird blender, attach the air and oxygen hose assemblies to the appropriate gas sources, and connect a high pressure supply hose from the blender outlet to the GAS INLET port on the ventilator.

Connect the 15mm patient tubing to the ventilator outlet port marked TO PATIENT (item number 5 on Figure 3.2, Pneumatic and External Power Panel Illustration), and connect the opposite end to the gas inlet port (item number 3 on Figure 3.3. Patient Valve Illustration) on the patient valve.

Connect one of the 1/8" CLEAR tubing pieces between the EXHALATION DRIVE (item number 4 on Figure 3.2, Pneumatic and External Power Panel Illustration) on the ventilator and the exhalation port (item number 1 on Figure 3.3, Patient Valve Illustration) on the patient valve.

Connect the other piece of 1/8" CLEAR tubing between the AIRWAY PRESSURE line port (item number 2 on Figure 3.2, Pneumatic and External Power Panel Illustration) on the ventilator and the pressure line port (item number 5 on Figure 3.3, Patient Valve Illustration) on the patient valve.

Attach the ANTI-SUFFOCATION VALVE (Item # 5 on Figure 3.3, Patient Valve Illustration) to the Patient Valve as shown in Figure 3.3.

If the ventilator is to be powered from an external power source, connect the AC power supply adapter or the 12 VDC power cable from the external power source to the ventilator EXTERNAL POWER input jack, item number 1 on Figure 3.2, Pneumatic and External Power Panel Illustration.

Note

The AC power supply adapter is preset for 115 VAC/50-400 Hz operation. If 230VAC/50-400 Hz use is required, the switch located on the AC adapter must be repositioned to the correct setting in order for the unit to function properly.

If the ventilator is to be operated from the internal battery, no power connections are necessary; however, please refer to Section 8.0, Maintenance and Service for proper battery care instructions.

4.3 Performance Check

WARNING

If the Bird Avian Portable Ventilator fails the Performance Check, do not attempt to operate the ventilator until the performance specifications have been restored and verified.

4.3.1 Preparation

Assemble the breathing circuit and attach it to the ventilator as described in paragraph 4.2 of this manual. If a humidifier is used, follow the manufacturer's instructions for use.

NOTE

If the removable PEEP valve is attached prior to this point and has a setting greater than 3 cmH_2O, the system will fail the start-up self-test.

Attach an high pressure supply hose from the external gas source to the ventilator GAS INLET port as described in paragraph 4.2 of this manual.

If an external power source is available, connect the External AC Power Supply to an AC power outlet and to the external electrical receptacle on the Avian.

4.3.2 Internal Self Test

Place the **MODE SWITCH** into the CAL position. At this point, the ventilator will begin a self-test. The power up self-test is performed before power is supplied to the ventilator control systems. During the self-test, the following test sequence occurs:

- Audible Alarm Sounds
- All LED Indicators On
- Memory Test
- EPROM Check Sum Test
- External Power
- Battery Status
- Pressure Transducer Verification
- All LED Indicators Off
- Displays current settings for Rate, Inspiratory Time, High and Low Pressure Alarms and Assist Sensitivity
- Audible Alarm Ceases

If the self-test detects a failure in any one of the above sequences, a CPU failure alarm will activate. This alarm cannot be silenced or canceled unless the unit is turned Off. If the test detects no failures, the system will become operational.

Once the self-test is completed, attach a test lung (Bird Products P/N 04845 or equivalent) to the patient connection (item number 6 on Figure 3.3, Patient Valve Illustration) on the patient valve.

Connect the removable PEEP valve to the 30mm exhalation outlet port (item number 2 on Figure 3.3, Patient Valve Illustration) on the patient valve.

4.3.3 Test Settings

WARNING

The operational parameter settings called out in these paragraphs are **ONLY** for the Performance Checks.

CONTROL	PARAMETER SETTING
Breath Rate	12 bpm
Inspiratory Time/Tidal Volume	1.0 Second
Flow	60 lpm

WARNING

The alarm settings called out in these paragraphs are **ONLY** for the Performance Checks.

ALARM PARAMETER	SETTING
High Pressure Alarm	Press the PIP button to obtain the peak pressure. Set the alarm 5 cmH_2O **above** the peak reading.
Low Pressure Alarm	Set the alarm 10 cmH_2O **below** the peak reading.

4.3.4 Testing

SET CONTROL	ANTICIPATED REACTION
PEEP Valve to 10 cmH_2O	Test continues at 12 bpm.
Set Breath Rate to 0 Display P_{aw}	The airway pressure should not drop more than 5 cmH_2O over a 20 second period.
Set the Breath Rate to 12 bpm	Return to a 12 bpm Breath Rate.

ALARM TEST PROCEDURE	ANTICIPATED REACTION
External Power: If an external power supply is being used, disconnect the power cord from the electrical outlet.	The audible/visual External Power Low/Fail alarm will activate, and the ventilator will continue to operate via the internal battery. Reconnect the power supply cord to the electrical outlet to deactivate alarm.
High Pressure:	Lower the High Pressure Alarm setting to 5 cmH_2O below the PIP reading. Verify that the High Peak Pressure audible/visual alarms activate. Inspiration will be terminated and the ventilator will cycle to exhalation. Reset the High Peak Pressure Alarm and depress the Alarm Silence/Reset button and verify that the alarm indications are cleared. Continue with the test procedure.

ALARM TEST PROCEDURE	ANTICIPATED REACTION
Low Pressure/Disconnect: Disconnect the test lung from the patient valve.	The Disconnect and Low Pressure audible and visual alarm(s) will activate. Reconnect the patient valve to the test lung to cancel the alarms once the ventilator cycles. Press the Alarm Silence/Reset button to cancel the visual indicator and resume alarm testing.
I:E Ratio Alarm: Adjust the Inspiratory Time/Tidal Volume control to the maximum setting of 3.0 seconds.	The audible and visual I:E Ratio alarms will activate immediately. Reset the Inspiratory Time control to 1.0 seconds to cancel the alarm condition.
Apnea Backup Alarm: Set Breath Rate to 1. Adjust the Mode control to the Assist/Control Mode.	After a 20 second interval has elapsed, the Apnea Alarm will activate both audible and visual alarms and will deliver a Controlled breath. Proceed to the next alarm verification test.
PEEP Not Set: With the Mode control at the Assist/Control setting, adjust the Manual PEEP Reference control to zero. Adjust the removable PEEP valve at the patient valve to 5 cmH_2O.	The PEEP Not Set alarm will activate audible and visual alarms. Adjust the Manual Set to 5 cmH_2O and return the Mode control to the Control setting to cancel the alarms. Depress the Alarm Silence/Reset to reset the visual indicators.

WARNING

If the Bird Avian Portable Ventilator fails the Performance Check, do not attempt to operate the ventilator until the performance specifications have been restored and verified.

After satisfactory completion of the Performance Check as outlined above, proceed to paragraph 4.4.

4.4 Start-up Instructions

WARNING

The Bird Avian portable ventilator is a restricted medical device. It is intended to be operated by qualified medical personnel under the direction of a qualified physician.

4.4.1 Ventilator Setup

Assemble the ventilator system as described in paragraph 4.2.

If using a Bird blender, attach the air and oxygen hose assemblies to the appropriate gas sources. If required, turn supply source valves open and check supply pressure.

If using a humidification device to humidify the inspired gas, follow the manufacturer's operating instructions.

If using an external power supply, connect the electrical AC power adapter to a properly grounded electrical outlet. Turn unit On by switching the Mode control from the Off position to the applicable ventilation mode.

4.4.2 Description of Ventilator Modes

4.4.2.1 Control Mode

All parameters of the delivered breath are controlled by the ventilator. The breath is initiated according to the Breath Rate control. Gas is then delivered to satisfy the requirements of the Flow and Inspiratory Time or Tidal Volume settings. The sensitivity control is non-operational in the Control mode.

4.4.2.2 Assist/Control

This mode allows the delivery of either a Controlled or an Assist/Controlled breath type. In effect, the patient is allowed to augment breath rate, but not flow or tidal volume. When this mode is selected, a visual indicator will light notifying the user that the patient trigger function is active. In the Assist/Control mode, the patient is able to initiate an Assist/Controlled breath if both of the following conditions exist:

- The ventilator is not currently in inspiration or the minimum exhalation phase, and;
- The patient inspiratory effort exceeds the Sensitivity trigger setting. After the initiation of a breath, gas is delivered to the patient in accordance with the Control settings. The patient is not permitted to augment the flow in this mode.

4.4.2.3 SIMV

In the SIMV mode,(Synchronized Intermittent Mandatory Ventilation) all control parameters are used, with PEEP and Sigh as optional controls. Depending on the control settings, ventilation can be totally patient controlled, or totally machine controlled with varying degrees of ventilator support between spontaneous breaths.

There are two types of breath periods in SIMV, both defined by the Breath Rate control. They are: Spontaneous breathing present, and; Spontaneous breathing not present. Descriptions are as follows:

• Spontaneous Breathing is present:

An "assist window" is opened at the beginning of a breath period. If a patient effort is detected (defined by the Sensitivity control) an Assist/Controlled breath is delivered in accordance with the ventilator settings. The patient is then allowed to breath spontaneously for the remainder of the breath period.

At the beginning of the next breath period, the assist window is reopened. If patient effort is detected, an Assist/Controlled breath is delivered and the cycle repeats.

• Spontaneous Breathing is not present

Following a complete breath period wherein spontaneous breathing is not present, at the beginning of the next breath period the ventilator will deliver a mandatory Controlled breath as determined by the ventilator settings. The assist window will then be immediately opened for the duration of the breath period. If a patient effort is detected, an Assist/Controlled breath will be delivered and the next breath period will be as described in the "Spontaneous Breathing present" paragraph.

4.4.2.4 CAL Mode

NOTE

Prior to entering CAL Mode, the patient should be disconnected from the ventilator and the patient port should be open.

Upon entering CAL mode a display test will activate, illuminating specific LED's. This function allows the user to verify the operation of membrane switches and associated LED's.

These LED's will be Illuminated:

- PEEP Not Set
- Battery Low/Fail
- Disconnect
- External Power (If Present)
- Apnea
- External Power Fail
- Power
- All segments of the Airway Pressure Bar Graph

Membrane switches, when pressed, will cause the associated LED to illuminate when the switches are pressed. Switches that have associated variable controls or alarms will display the value on the Monitor Display when the switch is pressed. The range and operation of the control can be checked by rotating the associated control through its range when the switch is pressed.

In CAL Mode, the ventilator will monitor the airway pressure transducer output for a maximum of 3 seconds. If the measured reading is within ± 3 cmH_2O of zero, the unit will store this offset and will add or subtract it from the pressure reading during normal operation to obtain corrected pressure. The unit will display PASS to indicate that the calibration has been successfully completed and the unit can be returned to normal operation.

If the measured reading is greater than ± 4 cmH_2O, the unit will sound an audible alarm and flash FAIL in the LED display. The unit will not store this value, and if returned to normal operation the unit will not apply an offset to the pressure transducer signal. Causes for CAL failure are excessive transducer drift and/or patient port not open.

4.4.2.5 Off Setting

When the Mode Control is in the Off position, all controls, settings and alarms, except the Ventilator Inop Alarm, are deactivated and are rendered non-operational.

To stop operations of the Bird Avian, turn the Mode Control to the Off position and press the Alarm Silence/Reset button.

4.5 Apnea Backup Ventilation

This is an automatic function of the Bird Avian portable ventilator, and is not a functional part of the control panel.

If the time between patient initiated breaths exceeds the 20 second Apnea Interval, the ventilator will automatically revert to the Assist/Control mode of ventilation. An audible alarm will sound, and the visual Apnea Alarm indicator will flash. The breath rate will be 12 BPM or the current Breath Rate setting, whichever is greater. Apnea Backup Ventilation can be terminated by clearing the Apnea Alarm with the Alarm Silence/Reset button. The Apnea Backup Alarm is not mutable.

4.6 Clinical Operation of Controls

4.6.1 Mode

Adjust the Mode selection control to the appropriate position for Control, Assist/Control, or SIMV.

4.6.2 Inspiratory Time/Tidal Volume

Select either the Inspiratory Time control or the Tidal Volume control by depressing the appropriate button. An LED associated with each button will remain permanently lit indicating the current selected control. If a new selection is made, the current setting of the new selection will flash in the monitor display for 6 seconds, allowing the user to adjust the setting. The new selection will not activate until the 6 second period has elapsed. Individual control procedures are as follows:

- Inspiratory Time

Adjust to the appropriate setting to establish the desired inspiratory duration for Controlled, Assist/Controlled or Apnea Back-up breaths.

- Tidal Volume

Adjust to the desired setting to establish the volume of gas delivered with each controlled, assist controlled or apnea back-up breaths.

NOTE

When inspiratory time exceeds expiratory time, the I:E Ratio alarm will be activated and will stay activated until the reverse I:E condition is corrected.

NOTE

Verify tidal volumes with a calibrated spirometer.

4.6.3 Breath Rate

Adjust to the appropriate setting to establish the minimum number of machine controlled and/or assisted breaths per minute.

4.6.4 Flow

Adjust to the appropriate setting to establish the peak level of gas flow during a machine controlled and/or assisted breath and for Apnea Backup Ventilation.

4.6.5 Sensitivity

Adjust to the appropriate level to determine the threshold level at which an assisted or a spontaneous breath will be initiated.

4.6.6 PEEP/CPAP

PEEP is provided by a removable PEEP valve located at the patient valve. Adjust the PEEP valve to establish the baseline pressure for all breath types.

4.6.7 Manual PEEP Reference

PEEP is automatically established by the ventilator through monitoring of the airway pressure, but can also be manually set via the Manual Set function.

By depressing the Manual Set button, an LED indicator is illuminated and the current PEEP reference level is displayed in the Monitor display. Holding the button depressed for longer than 3 seconds will initiate scrolling of the display from 0 to 20 cmH_2O. Releasing the button will freeze the display at the current setting, and the ventilator will use this value for PEEP reference. The indicator LED will remain lit for as long as the Manual Set function is active.

Activating the button while the LED is lit will cause the Manual Set function to deactivate the ventilator and to resume the auto set mode.

4.6.8 Sigh ON/OFF

Depress the Sigh button to deliver a Sigh breath in the next breath cycle. An LED will light indicating that Sigh has been activated. A sigh breath will continue to be delivered once every 100 breaths or 7 minutes, whichever comes first, regardless of breath type.

Sigh can be deactivated by depressing the Sigh button again, at which point the LED indicator will extinguish.

4.6.9 Manual Breath

WARNING

Depressing the Manual Breath button will cause gas to flow continuously until the button is released. Prior to use of this control, ensure that the over-pressure relief has been set to the desired level (see 4.6.10).

Depress this button to deliver a continuous flow of gas in accordance with the current Flow setting. A manual breath will not be delivered if activated during an inspiratory or minimum exhalation phase of a breath cycle of any breath type.

4.6.10 Pressure Relief Valve

Adjust to the appropriate level to determine maximum allowable pressure in the patient circuit by turning the control knob (shown as Item # 24 in Figure 3.1, Front Panel Illustration) clockwise (Increase) or counter-clockwise (Decrease). The desired level is set by observing the Airway Pressure Monitor, and typically is set to 10-15 cmH_2O above the High Pressure Alarm Setting unless pressure-limited ventilation is desired.

4.7 Clinical Operation of Alarms

WARNING

It is the responsibility of the clinician or user to establish and monitor the appropriate alarm settings for each patient and mode of ventilation.

4.7.1 High Peak Pressure

Adjust to an appropriate setting higher than the peak pressure reading on the Monitor display to establish the High Pressure limit, above which an audible alarm will sound, inspiration will be terminated and exhalation will begin. This alarm is active for all breath types.

WARNING

A setting of 100 cmH_2O will cause the audible portion of this alarm to become inactive.

NOTE

The alarm limit is automatically increased by 1.5 times the display setting (up to 100 cmH_2O) during the delivery of a Sigh breath.

4.7.2 Low Peak Pressure

Adjust to an appropriate setting lower than the peak pressure reading on the Monitor display. This alarm is active for Control and Assist/Control breaths.

4.8 Clinical Operation of Ventilation Modes

WARNING

Consult a qualified physician when using an air/oxygen blender for proper fractional inspired oxygen (FIO_2) concentrations.

WARNING

Monitor patient oxygen concentrations at or near the proximal airway. Use a calibrated oxygen analyzer to verify the oxygen concentrations.

4.8.1 Control Mode

Place the Mode Control switch in the Control Position. Adjust the following controls to the appropriate settings as outlined in paragraph 4.6 of this section.

Adjust alarms to the appropriate settings as outlined in paragraphs 4.7 of this section.

Verify that the ventilator is functioning properly.

REQUIRED SETTINGS	OPTIONAL SETTINGS
• Inspiratory Time/Tidal Volume	• PEEP/Manual Set
• Flow	• Sigh ON /OFF
• Breath Rate	

4.8.2 Assist/Control

Place the Mode Control switch in the Assist-Control Position. Adjust the following controls to the appropriate settings as outlined in paragraph 4.6 of this section.

Adjust alarms to the appropriate settings as outlined in paragraph 4.7 of this section.

Verify that the ventilator is functioning properly.

REQUIRED SETTINGS	OPTIONAL SETTINGS
• Inspiratory Time/Tidal Volume	• PEEP/Manual Set
• Flow	• Sigh ON /OFF
• Breath Rate	
• Sensitivity	

4.8.3 SIMV

Place the Mode Control switch in the SIMV Position. Adjust the following controls to the appropriate settings as outlined in paragraphs 4.6 of this section.

Adjust alarms to the appropriate settings as outlined in paragraphs 4.7 of this section.

Verify that the ventilator is functioning properly.

REQUIRED SETTINGS	OPTIONAL SETTINGS
• Inspiratory Time/Tidal Volume	• PEEP/Manual Set
• Flow	• Sigh ON /OFF
• Breath Rate	
• Sensitivity	

SECTION 5.0
Clinical Troubleshooting

5.1 Introduction

This section is made up of the Operator troubleshooting chart.

WARNING

Technical repairs should be accomplished by qualified personnel, trained either by the Bird Products Corporation or their authorized trainers. BIRD PRODUCTS CORPORATION IS NOT RESPONSIBLE FOR UNAUTHORIZED REPAIRS, OR REPAIRS MADE BY UNAUTHORIZED PROCEDURES.

5.2 Troubleshooting Chart

Symptom	Potential Cause	Corrective Action
Battery Low/Fail audible and visual alarm present.	The battery is discharged.	Recharge or replace the battery.
Battery Low/Fail visual alarm present.	The battery is below acceptable charging level or the battery has a shorted cell.	Replace the Battery.
CAL visual is flashing on the display with an audible alarm present.	The airway pressure transducer is out of calibration. Patient circuit is not open to ambient	Calibrate the airway pressure transducer in the **CAL** mode. Open patient circuit to ambient
Disconnect audible and visual alarm present.	Leaks or disconnect in the patient circuit and/or humidifier.	Check for leaks and/or disconnects.
Error Code is displayed on the display monitor.	This indicates there is a problem with the Main Printed Circuit Board.	Return the ventilator to an authorized technical service facility.
External Power Fail audible and/or visual alarm present.	No power to the external power adapter. External power adapter's line selector switch set to the wrong voltage. External power adapter is not connected to the ventilator.	Restore the external power. Set the line selector switch to the proper line voltage. (115 or 230 VAC). Connect the external power adapter to the ventilator.
FAIL visual is flashing on the display with an audible alarm present.	The patient circuit was not disconnected during the initial power on self test.	Disconnect the patient circuit and momentarily turn the **Mode Control** switch to the **Off** position.

Symptom	Potential Cause	Corrective Action
High Peak Pressure audible and/or visual alarm present.	Endotracheal tube occlusion. Alarm set below actual peak pressure. Change in patient compliance. Change in ventilation parameters. Obstructed or kinked exhalation drive line.	Check patient status. Readjust the alarm limit. Check patient and readjust alarm. Readjust the alarm setting. Check and clear the exhalation line.
I:E Ratio audible and/or visual alarm present.	Inspiratory time is set to greater than 50% of breath period. Breath Rate is set too high to allow 50% of period for the exhalation phase.	Readjust the Inspiratory time or the breath rate.
Low Peak Pressure audible and/or visual alarm present.	Change in patient compliance. Leaks or disconnect in the patient circuit and/or humidifier. Alarm set too high.	Evaluate patient status. Check for leaks and/or disconnects. Readjust the alarm setting.
Flow or Volume delivery is low.	The input gas pressure is not within the specified operating range of 40 to 60 psig. The flow control system is out of calibration.	Connect the ventilator to an inlet gas source that is in the 40 to 60 psig range. Return the ventilator to an authorized technical service facility for calibration.
VENT INOP audible and/or visual alarm present.	No power to the external power adapter. External power adapter is not connected to the ventilator. Internal battery is discharged. System or CPU failure.	Restore the external power. Connect the external power adapter to the ventilator. Recharge the battery. Return the ventilator to an authorized technical service facility.
Ventilator will not power up. No lights visible or audible alarms present.	No power to the external power adapter. External power adapter is not connected to the ventilator. Internal battery is discharged.	Restore the external power. Connect the external power adapter to the ventilator. Recharge the battery.

SECTION 6.0
Cleaning and Sterilization

6.1 Introduction

CAUTION

Do not sterilize the Bird Avian portable ventilator. The internal components are not compatible with sterilization methods.

CAUTION

External cleaning and sterilization of the Bird Avian with agents that include phenols, ammonium chloride, chloride compounds and/or those with a greater than 2% concentration of glutaraldehyde are not recommended. These agents may cause damage to plastic components and/or control panel overlays.

6.2 Ventilator

The Bird Avian should be kept clean and free of dirt at all times. Exposed parts and surfaces should be dried and cleaned if used in wet environments. Grease, dirt and oil should be prevented from entering the system or its components.

The exterior of the Bird Avian may be wiped clean with an appropriate bacterial or germicidal agent. If cleaning the front panel of the ventilator (underneath the protective clear cover), care should be taken not to allow liquid cleaning agents to pool in or around the controls. This will help minimize the potential for the liquid to penetrate the inside of the ventilator.

- **DO NOT** use harsh abrasives on the ventilator.
- **DO NOT** immerse the ventilator in liquid decontamination agents.
- **DO NOT** sterilize the ventilator.
- **DO NOT** allow bacterial or germicidal cleaning agents to pool on the front panel of the ventilator.
- **DO NOT** spray cleaning solution into any of the ventilator openings.

6.3 Patient Valve Assembly

Care should be exercised in cleaning the exhalation valve assembly. The exhalation valve is compatible with liquid agents, ethylene oxide (ETO) sterilization, or steam autoclave. If using a liquid agent to clean the patient valve, visually inspect all surfaces to ensure that all cleaning solution has been removed prior to placing the valve back into service.

6.4 Breathing Circuit

The ventilator breathing circuit, not including any accessories (such as a humidifier), may be sterilized with liquid agents, ETO sterilization or steam autoclave.

The reusable 1/8" tubing can be sterilized by being submersed in liquid agents, ETO sterilization or steam autoclave.

6.5 PEEP Valve/Anti-Suffocation Valve

The PEEP valve and/or the Anti-Suffocation valve may be sterilized with liquid agents, ETO sterilization or steam autoclave.

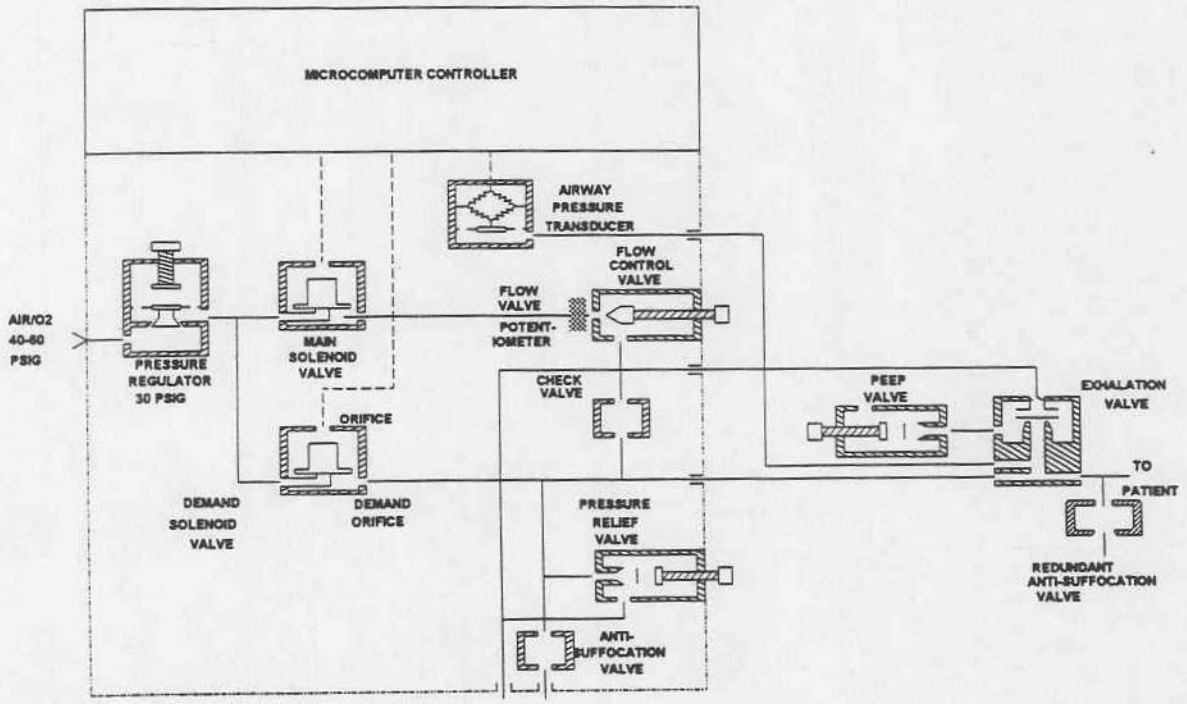
SECTION 7.0
Overview of System Operation

7.1 Introduction

The Bird Avian Portable Ventilator is an electronically controlled, pneumatically actuated ventilator, which can support many of the current modes of ventilation used for adult and pediatric patients. The unit can operate from a wide range of DC and AC power sources, and requires a gas source at 40 to 60 PSI. The electronic control system is microprocessor based, and interfaces to the pneumatic ventilation system through a series of solenoid valves and a pressure transducer.

The ventilator uses an exhalation valve and PEEP valve to complete the ventilation system and can also be equipped with an external air/oxygen blender to provide variable oxygen concentrations. The following theory of operation described in paragraph 7.2 refers to the Pneumatic Schematic 7.1.1.

7.1.1 Pneumatic Schematic



7.2 Theory of Operation

7.2.1 Gas Inlet and Pressure Conditioning

Air, oxygen, or blended gas from an external blender at 40 to 60 psig is connected to the ventilator O2 DISS gas inlet port. The gas flows to the **PRESSURE REGULATOR** where it is regulated down to 30 psig. This provides a stable pressure supply to the remaining flow control system and insures that the delivery of tidal volumes and demand flow is unaffected by inlet pressure variations.

7.2.2 Main Flow Control System

Gas then flows to the **MAIN SOLENOID VALVE,** which controls the flow of gas for controlled and assist controlled breaths. At the start of inspiration, the valve opens and gas flows through the **FLOW CONTROL VALVE** which throttles the flow to the desired level. The **FLOW CONTROL POTENTIOMETER** is attached to the **FLOW CONTROL VALVE** poppet senses the valve position. This information is used by the microprocessor to calculate tidal volume. Flow continues through the **CHECK VALVE** and out the inspiratory leg of the patient circuit to the patient. At the end of inspiration, the **MAIN SOLENOID VALVE** closes and stops the gas flow.

7.2.3 Exhalation Valve and Control System

When inspiratory flow is present as described in the previous section, a slight pressure drop exists across the **CHECK VALVE.** The upstream elevated pressure is fed to the **EXHALATION VALVE** balloon through the exhalation valve drive line that closes the **EXHALATION VALVE** at the beginning of inspiration. The balloon has an advantageous area ratio with the seat that coupled with the elevated pressure holds the **EXHALATION VALVE** closed during the inspiratory phase. When inspiratory flow is stopped, the exhalation balloon pilot pressure is bled off through the **ORIFICE.**

A removable spring loaded PEEP valve can be attached to the outlet port of the **EXHALATION VALVE** if PEEP is needed.

7.2.4 Demand System

When a spontaneous breath is triggered, the DEMAND SOLENOID VALVE opens and gas flows through the valve and the DEMAND ORIFICE where it is throttled to 60 LPM.

Gas then flows out through the inspiratory leg of the patient circuit to the patient. Since the flow bypasses the **CHECK VALVE**, the exhalation balloon drive pressure does not rise, leaving the exhalation valve open. Excess flow not demanded by the patient flows out of the **EXHALATION VALVE.** Demand flow stops when airway pressure rises above the reference baseline.

7.2.5 Pressure Relief Function/ Anti-Suffocation Valve

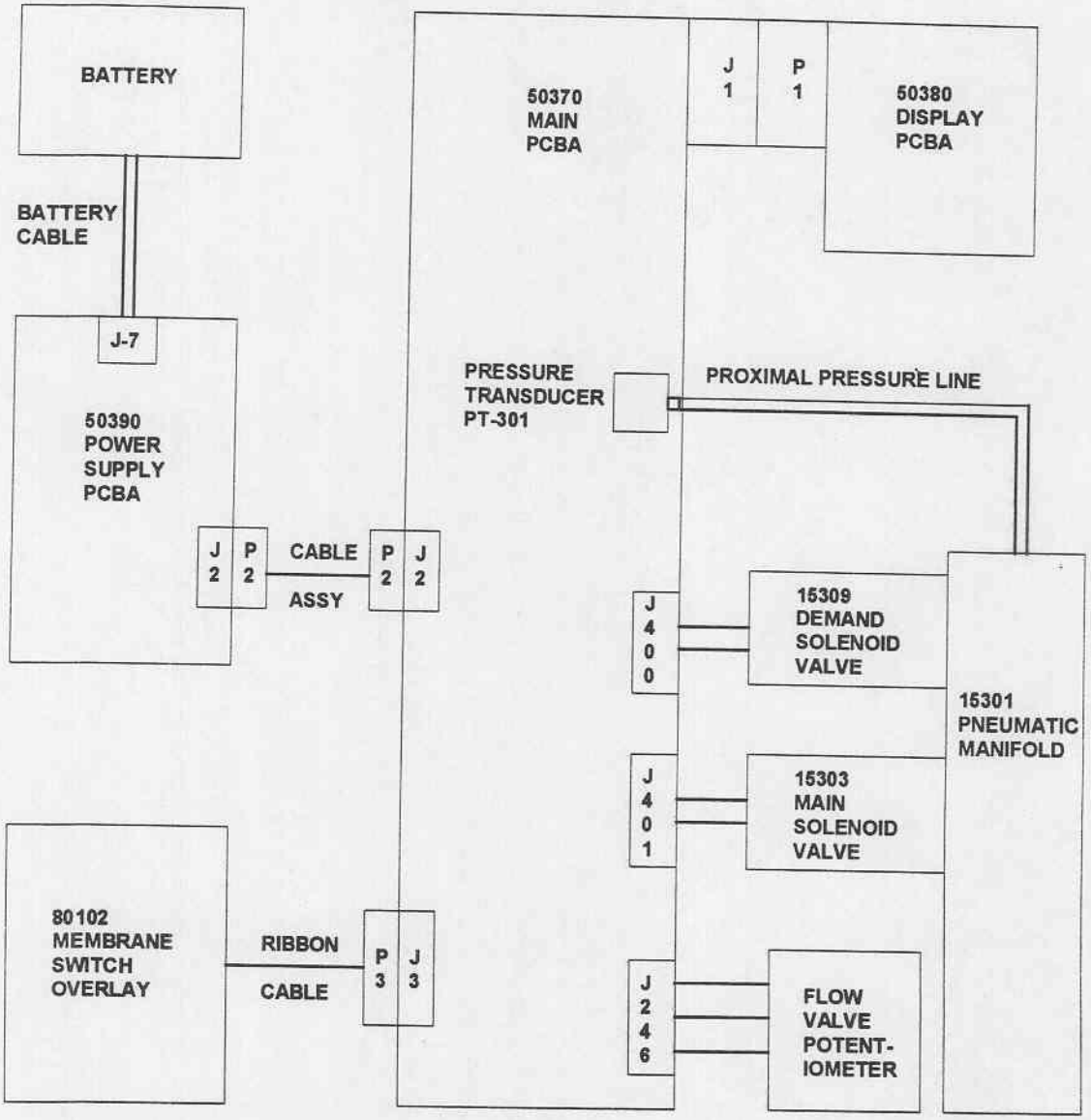
The pressure relief valve acts as a redundant safety feature or can be used to deliver pressure control breaths by establishing the maximum pressure in the patient circuit. If airway pressure exceeds the **PRESSURE RELIEF VALVE** setting, gas is vented to the room and the pressure is held constant at this level. When the inspiratory phase is complete or in case of a malfunction, the ventilator flow is shut off.

In case of a ventilator failure or insufficient ventilatory support, the patient can breathe directly from room air through the **ANTI-SUFFOCATION VALVE**, or through the **REDUNDANT ANTI-SUFFOCATION VALVE** if for some reason the Anti-Suffocation Valve is not functioning.

7.2.6 Airway Pressure Transducer

Pressure at the patient airway is measured and converted to an electrical analog signal by the **AIRWAY PRESSURE TRANSDUCER.** This pressure is used for the bar graph display, breath triggering, and the pressure alarms.

7.1.2 Electrical Block Diagram



7.3 Electronic Circuit Descriptions

7.3.1 Power Supply Board

- **Overview**

The power supply has four basic functional sections: Input power conditioning, battery charger, charger bypass power, and output voltage regulation. The schematic of this circuit board is found in Section 9.0, figure 9.7.1.

- **Input Power Conditioning**

External input power is applied through a bridge rectifier that allows application of a DC voltage without regard to polarity. AC voltage is also acceptable because a rectifier rectifies the AC. A capacitor provides the necessary filtering. The input can be DC voltage, (11 to 32 VDC), or an AC Voltage, (12 to 32 VAC, peak to peak). Fuse F700 protects against catastrophic failures such as shorted diodes.

- **Battery Charger**

The battery charger is a temperature compensated, current limited, dual-level float charger with a dead cell lockout. The charge cycle normally takes less than 24 hours.

Input power from the external power source turns on the charger. The battery is charged at the trickle current rate until the battery terminal voltage exceeds the charge enable threshold This protects the system against high charging current applied to a battery with a shorted cell, or a battery that is installed backwards.

NOTE

Batteries that do not meet the charge enable criteria within 24 hours are probably defective and should be replaced. This condition will be indicated by the front panel Battery Low/Fail Indicator being lighted while external power is present (even if the front panel Mode switch is in the Off position).

Once the battery voltage exceeds the charge enable threshold, the battery is placed in the bulk charge state. During the initial stages of charging a discharged battery, the charger may reduce the charge voltage to prevent the charge current from exceeding the 500 mA charge current limit.

The charger will provide currents of zero to 500 mA as required and maintain the regulated standby float voltage. If the battery terminal voltage drops to 90% of the standby float level, the charger will switch back to the bulk charge mode.

- **Charger Bypass Power**

The Charger Bypass Power circuit provides power to the ventilator electronics without passing that energy through the battery charger control circuit. This helps improve accuracy of the battery charging process, which helps maximize the battery service life.

7.3.2 Main Printed Circuit Board

- **Overview**

The Main Printed Circuit Board contains the circuits used to operate and control the Bird Avian. Each of the six (6) sheets contains different elements of the circuit board. Each sheet of the schematic is discussed separately. The schematics are located in Section 9.0 and are numbered figures 9.5.1 through 9.5.6 respectively.

- **Sheet 1, Figure 9.5.1**

This sheet contains the schematic interconnects between the main board schematic sheets and other system printed circuit boards, switches, and valves.

Sheet 1 Main Board Connectors	Connects To
J-1	Display Board
J-2	Power Supply Board
J-3	Membrane Switches
J-400	Demand and Flow Valves
J-246	Flow Valve Potentiometer

- **Sheet 2, Figure 9.5.2**

The analog-to-digital converter, the front panel control potentiometers, reference voltage multiplier string, potentiometer reference voltage generators, open potentiometer detector circuits, proximal pressure transducer, and the proximal pressure transducer amplifier are found on sheet 2.

Since the gain and zero offset are fixed in this circuit and the transducer characteristics vary, the calibration is performed in software by the master calibrate function. This operation is not intended for user access, but may be performed by a trained technician using tools and appropriate test equipment.

- **Sheet 3, Figure 9.5.3**

Sheet 3 contains circuits that are not available in the DEPMED version of the Bird Avian and are not discussed in this manual.

- **Sheet 4, Figure 9.5.4**

Sheet 4 contains the power supply fault monitor circuit, and the valve solenoid drivers.

- **Sheet 5, Figure 9.5.5**

The CPU, the Watchdog Timer and PAL, and the crystal clock generator are on this sheet. The CPU, U500, is an 8-bit 80C31. Program Memory is in U504, a 64k-byte 27C512 EPROM.

- **Sheet 6, Figure 9.5.6**

Sheet 6 contains the V_BAK supercap backup supply, the alarm driver, the Vent Inop LED driver, and the push-button switch read circuits.

The V-BAK supply is based around a super capacitor. This device is used to store energy that is used after a power failure to drive the audible alarm and the Vent Inop LED indicator.

7.3.3 Display Board

Figure 9.6.1 in Section 9.0 is the schematic diagram for the Display Printed Circuit Board. This board contains four basic sections: The 4-digit 7-segment numeric display, the twenty-six (26) software controlled alarm LED indicators, a 20-segment bar graph display, and three (3) discrete LED indicators..

The 4-digit 7-segment numeric display is shared by the monitor and display functions to display pressure, volume and flow information. The 20-segment bar graph is dedicated to display patient airway pressure. The software controlled LED indicators display alarm indicators. The three (3) discrete LED indicators are used to display Power, External Power, and Ventilator Inoperative conditions and are not under software control.

SECTION 8.0
Maintenance and Service

8.1 Introduction

This section includes recommended preventive maintenance procedures, battery care and replacement procedures, a technical troubleshooting chart, and repair and calibration procedures.

WARNING

Technical repairs should be accomplished by qualified personnel, trained either by the Bird Products Corporation or their authorized trainers. BIRD PRODUCTS CORPORATION IS NOT RESPONSIBLE FOR UNAUTHORIZED REPAIRS, OR REPAIRS MADE BY UNAUTHORIZED PROCEDURES.

WARNING

The Bird Avian should pass a full technical performance check following any repair procedure that requires the case to be opened.

8.2 Recommended Tools and Test Equipment

8.2.1 Special Tools and Test Equipment

The items listed in this table are available from Bird Products Corporation.

Part Number	Description
04845	Test Lung
15289	Patient Circuit

These special items are not available from Bird Products Corporation.

Item	Description
Anti-Static Cable	Anti-Static mat ground connector cable.
Anti-Static Mat	Workbench cover.
Anti-Static Strap	Wrist strap
Digital Voltmeter	Model 83, Fluke or equivalent
Pneumatic Test Set	Model RT-200, Timeter or equivalent
Stopwatch	Digital or analog.
Syringe	1 liter capacity, with tracheal adapter, Hamilton P/N 86302 or equivalent
Syringe	50cc
Torque Screwdriver	0 - 100 inch/ounce with 5/64" Allen Driver.
DC Power Supply	0 - 6 VDC, Variable Power Supply.
Variable AC Power Transformer	Variac, 0 - 140 VAC, 0 - 240 VAC.

8.2.2 Common Tools

Item	Description
Allen Hex Drivers	3/16",3/32",7/64", 9/64", 5/32" (Xcelite or equivalent)
Diagonal Cutter	
Hemostat	Four Inch or equivalent
Needle Nose Pliers	Long thin nose pliers.
Screw Driver, Phillips	# 2 Phillips, 6" shaft

8.3 Preventive Maintenance

The Bird Avian ventilator is designed to provide the maximum amount of utilization with a minimum amount of maintenance. When determining the frequency of required preventive maintenance, many factors must be considered, including:

- Frequency and length of use
- Quality of the compressed air source(s)
- Environmental conditions

The Bird Avian, like other pieces of Health Care equipment, will require routine maintenance over time. Refer to the following for recommended maintenance intervals.

8.3.1 Recommended Maintenance Schedule

INTERVAL	RECOMMENDED PROCEDURES
Once Every Month	Verification of Performance: Perform a ventilator Performance Check as outlined in Section 5. If the ventilator does not perform to stated specifications, remove the unit from service and refer the ventilator to technical service.
Annual Inspection	Complete the preventive maintenance inspection procedures outlined in paragraph 8.3.2., and the test procedures outlined in paragraph 8.5.
Every two (2) years	A complete ventilator maintenance will be required at a minimum of once every two (2) years. The Bird Avian should be repaired and/or calibrated only by a Bird trained service technician or Bird Products Corporation.

8.3.2 Preventive Maintenance

Visually inspect the Bird Avian for damage to the covers, knobs and controls. Remove the battery and inspect for cracks in battery case and for leakage of the electrolyte.

Replace the Muffler Bleed Filter (P/N 03319) during the annual or bi-annual inspections. Refer to section 8.7.1 for removal and replacement instructions.

Complete the performance check outlined in paragraph 8.5. Units that fail to pass the performance check should be repaired and/or calibrated as needed to pass the test. Refer to the Technical Troubleshooting chart or calibration procedure to make the necessary repairs.

8.4 Battery Care

CAUTION

Prolonged storage at high temperatures (above 80°F (27°C)) can result in premature battery failure. Failure to recharge the battery while it is in storage will also cause premature failure of the battery.

The internal battery of the Bird Avian offers a wide operating range, simple recharge procedures and uncomplicated battery replacement. Battery life will depend on their use and maintenance.

NOTE

Batteries that do not meet the charge enable criteria within 24 hours are probably defective and should be replaced. This condition will be indicated by the front panel Battery Low/Fail Indicator being illuminated while external power is present (even if the front panel Mode switch is in the Off position).

Bird Products Corporation recommends that in periods of disuse, the batteries should be charged once every two months. To recharge the battery, simply connect the AC power supply adapter or the 12 VDC power cable to the POWER INPUT jack on the ventilator and connect the AC power supply adapter or the 12 VDC power cable to the proper power source. Recharge time will typically be between 14 - 16 hours.

8.4.1 Battery Replacement

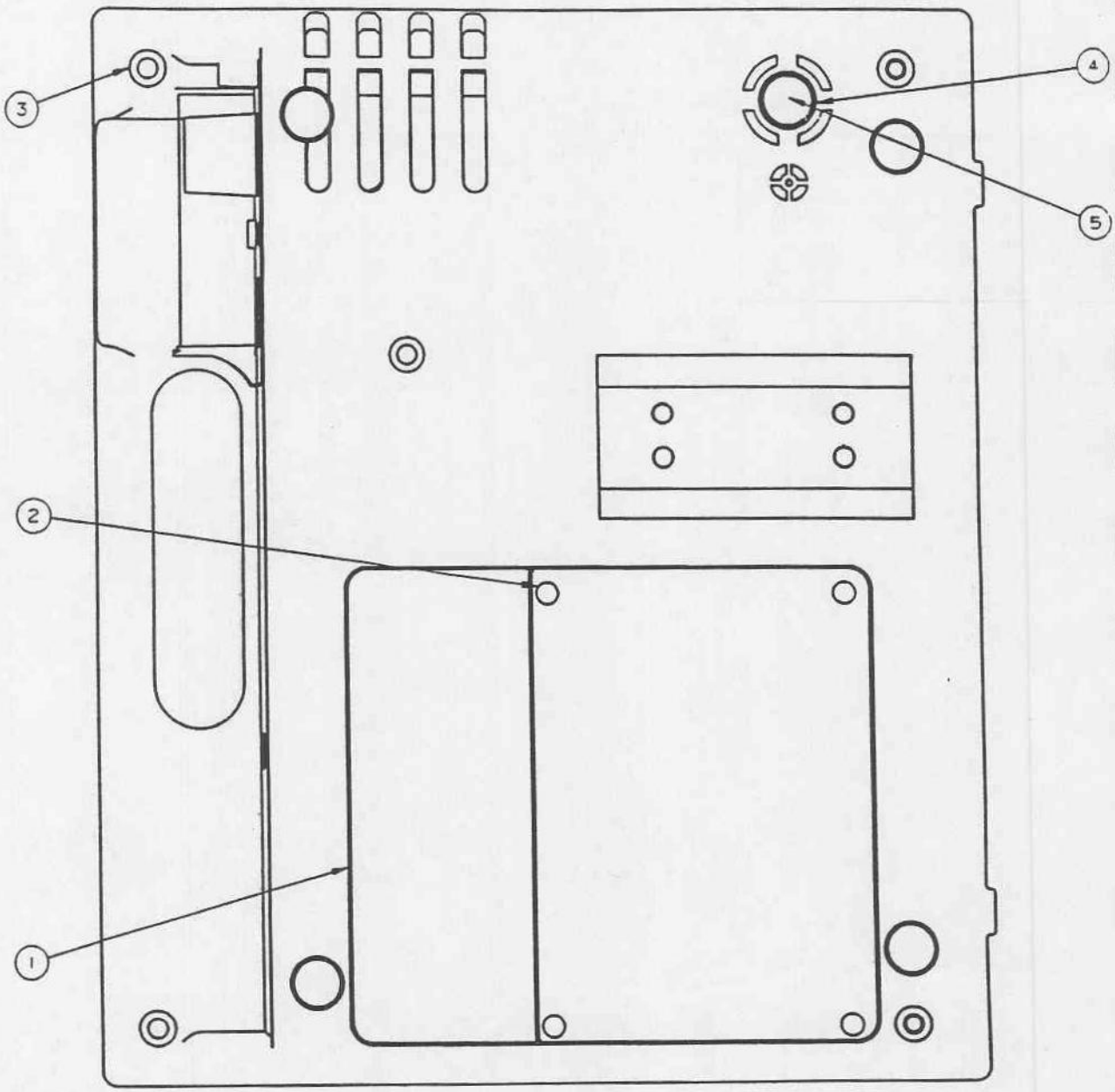
CAUTION

The correct polarity must be observed when the battery is replaced. The RED connector on the Avian battery cable connects to the [+] battery terminal. The BLACK connector on the Avian battery cable connects to the [-] battery terminal.

To replace the battery, follow the procedures listed below. Always complete a performance check as outlined in Section 5.0 upon completion of the battery installation.

- Disconnect the External AC Power Source from the wall and from the Bird Avian.
- Locate and remove the four (4) screws (Item number 2 on Figure 8.4.1, Battery Compartment) that hold the Battery Compartment Cover Item number 1 on Figure 8.4.1, Battery Compartment) to the bottom case half.
- Carefully remove the battery from the compartment and disconnect the battery electrical connector.
- Remove the old battery and install the new one.
- Reconnect the battery electrical connector. Make certain that the BLACK battery cable connector is connected to the negative [-] battery terminal and that the RED battery cable connector is connected to the [+] battery terminal.
- Replace the Battery Compartment Cover.
- Complete the performance check specified in Section 5.0, paragraph 5.3.

Figure 8.4.1 Battery Compartment Illustration



Item Number	Description
1	Battery Compartment Cover
2	Battery Cover Screw (6-32 X .250, 4 locations)
3	Avian Case Screw (10-32 X .375, 5 locations)
4	Bleed Muffler Retainer
5	Bleed Muffler

8.5 Test Procedures

CAUTION

The calibration accuracy of all test equipment used to test and calibrate the Bird Avian should be verified before recalibrating the ventilator.

NOTE

The assumption is made that all service technicians are familiar with the operation of the test equipment that is specified in this section. References will be made to the test equipment but test equipment operating instructions are not included in the test procedures. Please refer to the individual test equipment manufacturer's operating manuals for specific instructions.

The calibration procedures for the Bird Avian are software driven. There are no calibration curves to plot or potentiometers to adjust. The calibration data is stored in the EPROM.

8.5.1 Avian Test Settings

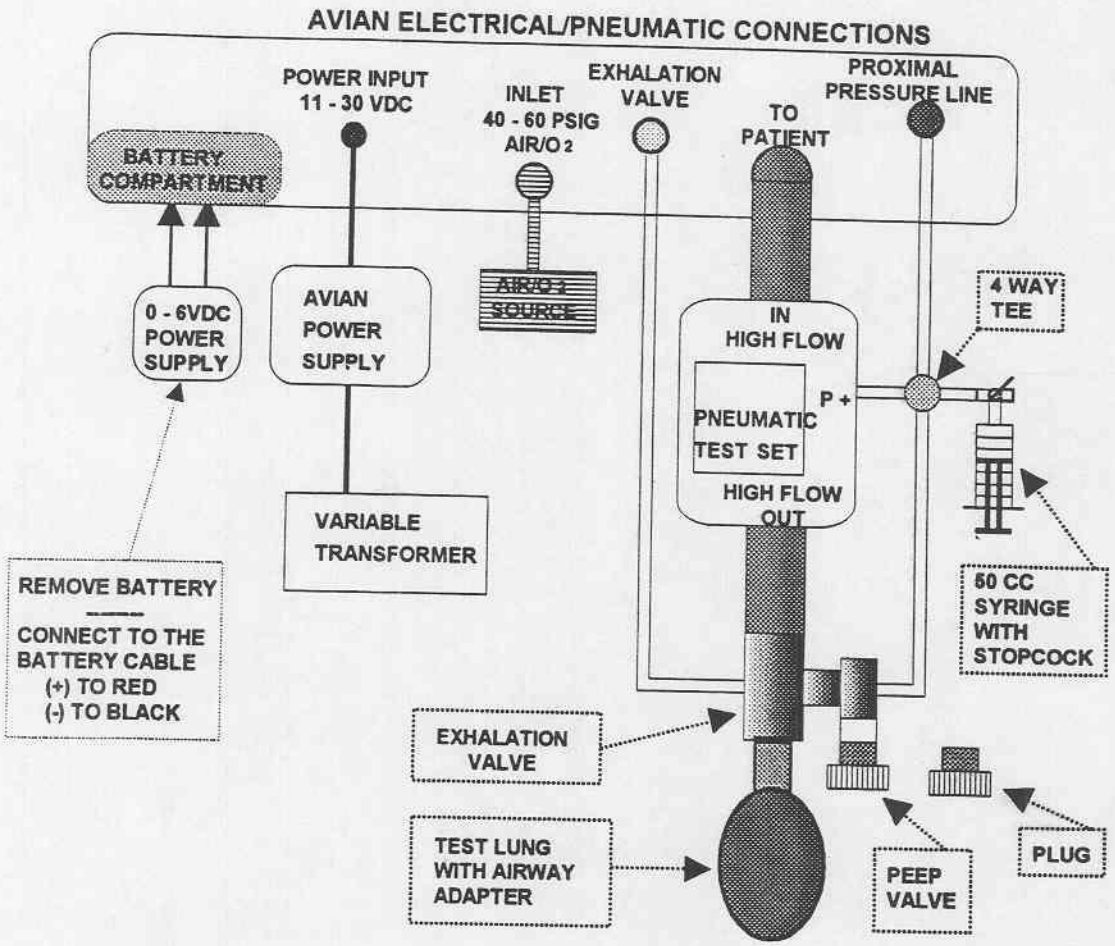
NOTE

These are the control and alarm settings to be used for the test and calibration procedures, unless there are specific instructions to change the settings.

CONTROL	PARAMETER SETTING
Breath Rate	12 bpm
Assist Sensitivity	-4 cmH_2O
Over Pressure	Maximum
Inspiratory Time	0.5 Second
Flow	60 lpm

ALARM PARAMETER	SETTING
High Pressure Alarm	Press the PIP button to obtain the peak pressure. Set the alarm 5 cmH_2O **above** the peak reading.
Low Pressure Alarm	Set the alarm 10 cmH_2O **below** the peak reading.

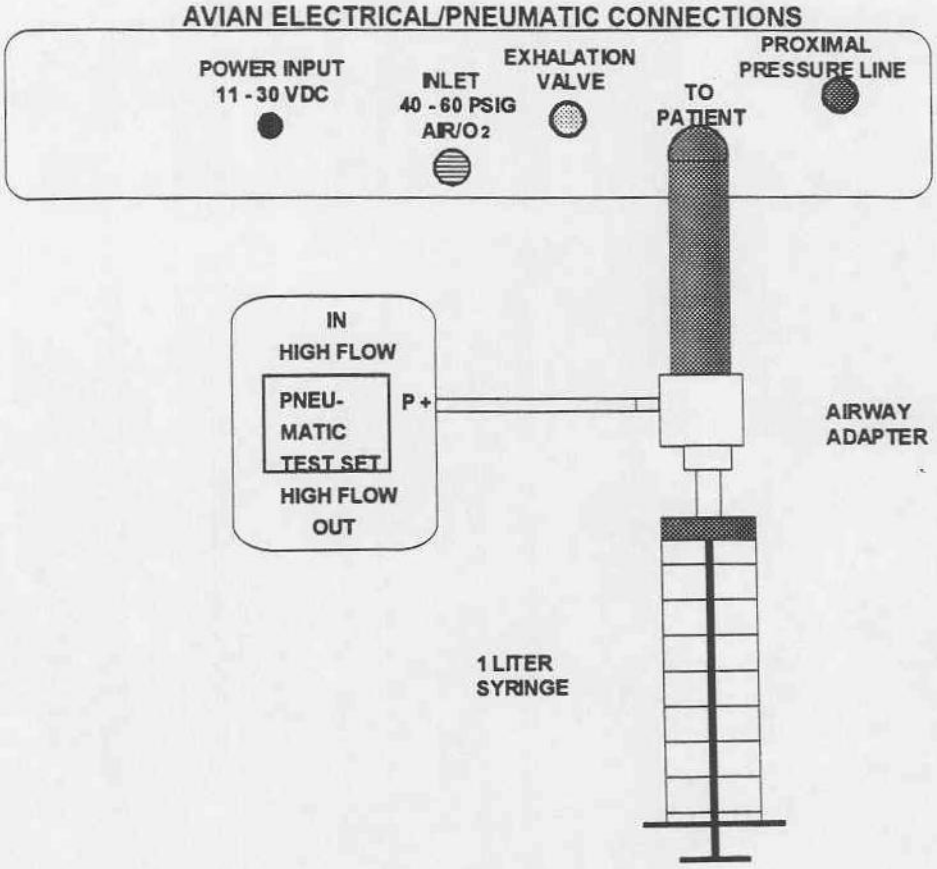
8.5.2 Standard Test Diagram



STANDARD TEST
ALARM AND CONTROL SETTINGS

ASSIST SENSITIVITY	-4 cmH2O
BREATH RATE	12 BPM
OVER PRESSURE	MAXIMUM
INSPIRATORY TIME	0.5 SECONDS
FLOW	60 LPM
HIGH PRESSURE ALARM	5 cmH2O Above PIP
LOW PRESSURE ALARM	10 cmH2O Below PIP

8.5.3 Anti-Suffocation Valve Test Diagram



APNEA TEST
ALARM AND CONTROL SETTINGS

VENTILATOR	OFF

8.5.4 Testing

NOTE

Whenever the (*) appears in the figure number column of the following table, the technician will be required to change the standard test configuration. Please read the test procedure before performing the test.

TEST	FIGURE NO	PROCEDURE
Internal Self Test	8.1(*)	Disconnect the tube that is connected to the PROXIMAL PRESSURE LINE port on the Avian. Turn the MODE switch to the SIMV position and the ventilator will automatically perform a series of internal checks. Verify the following: Audible Alarm Sounds All LED Indicators On All LED Indicators Off Current Settings (displayed on monitor) for: Rate, Inspiratory Time, High and Low Pressure Alarms and Assist Sensitivity Audible Alarm Ceases
Alarm Silence/Reset	8.1	This function is tested several times as part of the test in this performance check. Verify that the alarm does silence or reset as stated in the test procedures.
Apnea Alarm	8.1	Set BREATH RATE control to 1 bpm. After a 20-second interval the Apnea Alarm will activate the audible and visual alarms and the ventilator will deliver controlled breaths at a rate of 12 bpm. Press the ALARM/RESET button to clear the alarm. Reset the BREATH RATE control to 12 bpm and resume testing.
Breath Rate	8.1	Select the breath rate mode on the pneumatic test set. Depress the Breath Rate Display switch on the Avian to display the breath rate on the ventilator monitor display and compare it to the pneumatic test set breath rate. Verify that the breath rates match to ± 1 bpm.
Disconnect and Low Peak Pressure Alarms	8.1	Disconnect the Test Lung from the exhalation valve. Verify that the Disconnect and Low Pressure audible and visual alarm(s) activate. Reconnect the test lung to the exhalation valve to cancel the alarms.(An Apnea alarm will sound after 20 seconds). Press the Alarm Silence/Reset button to cancel the visual indicator and resume testing.

TEST	FIGURE NO	PROCEDURE
Self CAL/Display Test Mode	8.1 (*)	Place the MODE SWITCH in the Off position. Disconnect the Proximal Pressure line at the Exhalation Valve and attach the 50cc syringe to the proximal pressure line that connects to the ventilator. Place the mode switch in the CAL position. The ventilator will monitor the airway pressure transducer output for a maximum of 3 seconds. If the measured reading is within ±3 cmH_2O of zero, the unit will display PASS on the monitor display. Verify the following Indicators are illuminated: • PEEP Not Set • Apnea • Battery Low/Fail • External Power Fail • Disconnect • Power • External Power (if connected) • All Airway Pressure Bar Graph Segments Verify that all LED indicators that are associated with switches illuminate when the switch is pressed. Verify that control values are displayed on the monitor display when the function switch associated with the control is pressed and that all control potentiometers will rotate through their full range. Place the MODE SWITCH in the Off position. Clamp off the end of the Proximal Pressure line that was disconnected at the Exhalation Valve with hemostats. Apply a pressure to the line (as read on the pneumatic test set) with the 50cc syringe that is greater than ±4 cmH_2O. Place the MODE SWITCH in the CAL position. The ventilator will sound an audible alarm and flash FAIL in the monitor display. (The unit will not store this value). Place the MODE SWITCH in the Off position and remove the syringe from the proximal pressure line. Reconnect the Proximal Pressure Line to the Exhalation Valve.
Flow	8.1	Disconnect the Test Lung and set the Inspiratory Time to 1.0 seconds. Verify that a flow of 60 lpm ± 6 lpm is displayed on the pneumatic test set. Repeat the test for flows of 10 lpm ± 2 lpm and 100 lpm ± 10 lpm.
High Peak Pressure Alarm	8.1	Lower the High Pressure Alarm setting to 5 cmH_2O below the PIP reading. Verify that the High Peak Pressure audible/visual alarms activate. Inspiration will be terminated and the ventilator will cycle to exhalation. Reset the High Peak Pressure Alarm and depress the Alarm Silence/Reset button and verify the alarm indications are cleared. Continue with the test procedure.

TEST	FIGURE NO	PROCEDURE
I:E Ratio Alarm	8.1	Adjust the Inspiratory Time control to the maximum setting of 3.0 seconds. Verify that the audible and visual I:E Ratio alarms activate immediately. Reset the Inspiratory Time control to 0.5 seconds to cancel the alarm condition.
Demand Flow/Assist Sensitivity	8.1	Remove the PEEP valve and open the stopcock on the 50 cc syringe. Disconnect the Proximal Pressure line at the Exhalation Valve and clamp off the end of the line. Set Man. PEEP Ref. to zero (0). Set Breath Rate Control to minimum (full CCW). Press P_{aw} and display airway pressure. Set the pneumatic test set to read flow. Pull (retract) the plunger on the 50cc syringe to generate a pressure of -5 cmH_2O as read on the Avian display. Verify a flow of 60 lpm ± 6 lpm is displayed on the pneumatic test set. Flow time is ≅ 3 seconds. Reconfigure to the standard test configuration in figure 8.1.
Inspiratory Time	8.1	Set the pneumatic test set to display inspiratory time. Press the INSP. TIME display button on the Avian and verify the setting that is displayed on the ventilator compares to that of the pneumatic test set display.
Leak Check	8.1 (*)	NOTE Make sure the breathing circuit is tight before starting this test. Small leaks in the circuit will cause the test to fail. Set the display on the Avian to read P_{aw} and the Breath Rate to minimum (full CCW).Remove the PEEP valve and install a plug in the outlet port of the Exhalation Valve. Press the Manual Breath switch to deliver a manual breath. Wait 3 - 5 seconds and record the airway pressure. Wait an additional 30 seconds and record the airway pressure again. Subtract this reading from the previous reading. The difference should be < 5 cmH_2O. Reconnect to the standard test configuration, figure 8.1.
Power Indicator	8.1	This is a green LED that will light whenever the MODE switch is any position other than Off.
Sigh Breath	8.1	Set the Tidal Volume to 500 ml and activate the Sigh function. Verify the next breath tidal volume is 750 ml ± 75 ml as measured on the pneumatic test set. Restore to the standard test configuration, figure 8.1.

TEST	FIGURE NO.	PROCEDURE
Over Pressure Relief	8.1	Set the display to P_{aw} and the following controls: Pressure Relief - Full CW (Minimum) Breath Rate - Minimum (full CCW) Tidal Volume - 2000 Flow - 60 lpm Verify the airway pressure is limited to < 10 cmH_2O. Set the Pressure Relief to maximum (full CCW). Verify the airway pressure is limited to 115 cmH_2O ± 15 cmH_2O.
PEEP Not Set Alarm	8.1	Set the Avian to display P_{aw} and the following controls: Man. PEEP Ref. - Zero (0) Assist/Sensitivity - -8 cmH_2O Adjust the PEEP Valve at the Exhalation Valve to 5 cmH_2O as observed on the Avian display. Verify that the PEEP Not Set audible and visual alarms activate. Adjust the Man. PEEP Ref. control to 5 cmH_2O and verify that the audible alarm resets. Press the Alarm Silence/Reset to reset the visual indicator. Restore the test setup to the standard test configuration, figure 8.1.
Pressure Transducer	8.1	Set the Avian to display P_{aw} and disconnect the Proximal Pressure line at the Exhalation Valve. Verify the display reads 0.1 cmH_2O. Clamp off the disconnected end of the proximal pressure line. Open the stopcock on the 50 cc syringe to the proximal pressure line and press in the plunger to apply 100 cmH_2O on the Avian display. Verify the pneumatic test set reads 100 cmH_2O ± 5 cmH_2O. Restore to the standard test configuration.
Battery Low/Fail Manual Breath	8.1	Disconnect the Avian External Power Supply from the ventilator. Reduce the voltage on the 0 - 6 VDC Power Supply to 5.6 VDC. The Battery Low/Fail will flash and an audible alarm will sound. Press the Silence/Reset switch and the audible alarm will silence. The Battery Low/Fail light will continue to flash. Press the Manual Breath and verify that the ventilator will deliver a manual breath. Reduce the voltage to 5.1 VDC. The audible alarm sounds and the Vent Inoperative visual indicator illuminates. Press the Silence/Reset switch and verify that the audible and visual alarms remain on. Increase the voltage to 6.0 VDC. The audible alarm will silence. The Vent Inoperative visual indicator will remain on until the Silence/Reset switch is pressed.

TEST	FIGURE NO	PROCEDURE
External Power Low/Fail Alarm	8.1	Connect the Avian External Power Supply and disconnect the battery test connector. Set the External Power Supply voltage to 11 VDC and verify that the External Power indicator is illuminated. Gradually reduce the External Power Supply voltage to 10 VDC and verify that the External Power Fail indicator illuminates. Return the voltage to 11 volts.
Anti-Suffocation Valve	8.2	Turn the Avian ventilator off. Connect the 1 L. syringe, (with the plunger pressed all the way in), as illustrated in figure 8.2. Pull on the syringe plunger to withdraw 1 liter of air in approximately 2 seconds. Verify that the pressure displayed on the pneumatic test set does not go below -4 cmH_2O.

8.6 Technical Troubleshooting Chart

NOTE

The Technical Troubleshooting chart is available for trained service personnel. Untrained personnel should limit their repairs to the steps outline in the Clinical Troubleshooting chart in Section 5.0.

NOTE

A performance test should be completed before proceeding with repairs. The technical performance test in paragraph 8.5 will enable the technician to validate the complaint and to observe the symptoms.

NOTE

Good troubleshooting protocol is to always check all connectors and cabling before making any tests and/or adjustments.

Symptom	Possible Cause	Corrective Action
Airway Pressure Monitor Inoperative	Display PCBA Main PCBA	Replace the defective sub-assembly.
APNEA Alarm	Main PCBA	Replace the defective sub-assembly.
Auto Cycling of the Ventilator	Pneumatic Manifold Main PCBA	Replace the defective sub-assembly.
Battery Low/Fail Alarm - Audible and visual alarm.	Battery Power Supply PCBA Main PCBA	Replace the defective sub-assembly.
Battery Low/Fail Alarm - Visual alarm.	Battery is below acceptable charging voltage or the battery has a shorted cell.	Replace the battery.
CAL visual is flashing on the display and an audible alarm is present.	The airway pressure transducer is out of calibration.	Calibrate the airway pressure transducer in the **CAL** mode.

Symptom	Possible Cause	Corrective Action
Disconnect Alarm	Exhalation Valve Main Solenoid Valve Demand Solenoid Valve Pressure Regulator Pneumatic Manifold Assembly Main PCBA	Replace the defective sub-assembly.
Error Code is displayed on the monitor display.	Main PCBA	Replace the defective sub-assembly.
FAIL visual is flashing on the display with an audible alarm present.	The patient circuit was not disconnected during the initial power on self test.	Disconnect the patient circuit and momentarily turn the **Mode Control** switch to the **Off** position.
External Power Fail Alarm	No power to the external power adapter. External power adapter's line selector switch set to the wrong voltage. External AC Power Source External Power Connector sensor on the Avian Blown Fuse on Power Supply Power Supply PCBA Main PCBA	Restore the external power. Set the line selector switch to the proper line voltage. (115 or 230 VAC). Replace the defective sub-assembly.
High Peak Pressure Alarm	Change in ventilation parameters. Obstructed or kinked exhalation drive line. Exhalation Valve PEEP Valve Main Solenoid Valve Pneumatic Manifold Assembly Main PCBA	Readjust the alarm setting. Check and clear the exhalation line. Replace the defective sub-assembly.
I:E Ratio Alarm	Inspiratory time is set to greater than 50% of breath period. Breath Rate is set too high to allow 50% of period for the exhalation phase Main PCBA	Readjust the Inspiratory Time or the Breath Rate. Replace the Main PCBA.
LED(s) Inoperative	Display PCBA Main PCBA	Replace the defective sub-assembly.
Low Flow - Low Volume	External Air/O_2 Supply The flow control system is out of calibration.	Increase the external Air/O_2 Supply pressure.

Symptom	Possible Cause	Corrective Action
Low Peak Pressure Alarm	Alarm set too high. Leaks or disconnect in the patient circuit and/or humidifier. Exhalation Valve Main Solenoid Valve Pressure Regulator Pneumatic Manifold Assembly Main PCBA	Readjust the alarm setting. Check for leaks and/or disconnects. Replace the defective sub-assembly.
Membrane Switch(s) Inoperative	Membrane Switch Assembly Main PCBA	Replace the defective sub-assembly.
Mode Switch Inoperative	Main PCBA	Replace the defective sub-assembly.
Monitor LED Display Segment(s) Inoperative	Display PCBA Main PCBA	Replace the defective sub-assembly.
PEEP Not Set Alarm	Main PCBA Demand Solenoid Valve Pneumatic Manifold Assembly	Replace the defective sub-assembly.
Pressure Relief Valve Inoperative	Pneumatic Manifold Assembly	Replace the defective sub-assembly.
Transducer Calibration Failure	Main PCBA	Replace the defective sub-assembly.
Vent Inoperative Alarm	Main PCBA Power Supply PCBA	Replace the defective sub-assembly.
Ventilator will not power up from the internal battery. No lights visible or audible alarms present.	The battery is discharged below the acceptable level.	Replace the battery.

8.7 Disassembly - Reassembly Instructions

CAUTION

Before opening the case of the Bird Avian, place the ventilator Mode Switch in the Off position, remove the battery, and disconnect all external power and pneumatic connections from the unit.

CAUTION

Always follow proper static grounding procedures when removing and replacing the Bird Avian printed circuit boards.

8.7.1 Avian Case

Place the Bird Avian on a suitable work surface with the bottom of the case facing upward. Disconnect all external power and pneumatic connections to the ventilator. Remove the battery compartment screws (Item number 2 in Figure 8.4.1, Battery Compartment Illustration), remove the Battery Compartment door and remove the battery. Remove the muffler retainer and bleed muffler (Item numbers 4 and 5 on Figure 8.4.1, Battery Compartment Illustration) from the bottom case. Locate and remove the five (5) screws (Item number 3 in Figure 8.4.1 Battery Compartment

Illustration) that hold the case halves together. Carefully separate the top and bottom case halves. Disconnect the bleed tube for the solenoid valves and the main solenoid valve exhaust line from the bottom case. Disconnect P-8, the Battery Cable from the Power Supply PCB. The bottom case is now free to be removed.

When all necessary repairs have been completed, reassemble the case. Reconnect the Battery Cable P-8. Reconnect the main solenoid valve exhaust tube and the bleed line to the bottom case. Install new bleed muffler and muffler retainer. Insure that all cables are properly located, and all connectors are secure before reassembling the case. Place the top case face down on the work surface. Carefully mate the bottom case half to the top half. Replace the five (5) screws used to hold the case halves together. Replace the battery and battery compartment cover.

Complete a technical performance check, paragraph 8.5.3, before returning the Bird Avian to service.

8.7.2 Power Supply Printed Circuit Board

Open the Avian Ventilator case (paragraph 8.7.1). Locate and disconnect P-2 at the Power Supply PCB. Remove the three (3) mounting screws that secure the board to the Pneumatic Manifold Assembly.

To reinstall, attach the Power Supply PCBA to the manifold with the three mounting screws. Reconnect the connector P-2. Complete the reassembly instructions in paragraph 8.7.1.

8.7.3 EPROM Replacement

Follow the instructions in paragraph 8.7.1 to open the Avian case. Remove the Power Supply PCBA (paragraph 8.7.2). Locate the EPROM on the Main Printed Circuit Board and remove the integrated circuit with an IC removal tool.

CAUTION

Use caution when installing the new IC. Pay close attention to the pin alignment and location of pin one (1). Be careful not to bend the IC pins when inserting the EPROM.

Insert the new EPROM in the socket. Install the Power Supply PCBA (paragraph 8.7.2) and reassemble the case (paragraph 8.7.1.)

8.7.4 Pneumatic Manifold Assembly

Follow the disassembly instructions in paragraphs 8.7.1 and 8.7.2 to open the ventilator case and remove the Power Supply PCBA. Locate and disconnect P-400 (Demand Solenoid Valve) and P-401 (Flow Solenoid Valve) cables. Disconnect P-246 (Flow Valve Solenoid) cable. Remove the hex head screw that secures the manifold to the case and remove the Pneumatic Manifold Assembly from the case.

To reassemble, position the Pneumatic Manifold Assembly in the case and install the hex head screw to secure the manifold to the case. Reconnect P-400, P-401 and P-246. Continue the reassembly process by following the instructions in paragraphs 8.7.1 and 8.7.2.

8.7.5 Main Printed Circuit Board

To remove the Main PCBA, follow the instructions in paragraphs 8.7.1, 8.7.2 and 8.7.4. Continue by removing all of the control knobs except the Pressure Relief and Flow Control knobs. Locate and remove the screws that secure the circuit board

assembly to the case. Carefully lift the circuit boards (Main and Display PCB assemblies) from the case. Separate the Main and Display printed circuit boards.

NOTE

Use caution and insure proper alignment of the connector when reassembling the Main and Display printed circuit cards.

Connect the Main and Display circuit boards. Position the boards in the case and secure the assembly with the mounting screws. Replace the control knobs and continue with reassembly by following the instructions in paragraphs 8.7.4, 8.7.2 and 8.7.1.

8.7.6 Display Printed Circuit Board

Follow the disassembly and reassembly instructions for the Main PCBA contained in paragraph 8.7.5.

8.7.7 Demand or Main Solenoid Valve Replacement

NOTE

Both the Demand and Main Solenoid Valves will be free once the Solenoid Valve Mounting Bracket is removed. Use caution to prevent dropping the valves.

Remove the Pneumatic Manifold Assembly per the instructions contained in paragraphs 8.7.4. Remove the cable ties from the solenoid valve control cables. Locate the Solenoid Valve Mounting Bracket and remove the screws that secure the valves to the manifold. Pull both valves away from the manifold. Remove the bleed line from the valve that is to be replaced.

Reconnect the bleed line to the new valve. Position the valves on the Pneumatic Manifold Assembly and install the Solenoid Valve Mounting Bracket. Continue the reassembly process detailed in paragraph 8.7.4.

8.7.8 Overlay (Keypad)/Switch Panel Replacement

Disassemble the case by following the steps outlined in paragraph 8.7.1. Remove the Pneumatic Manifold Assembly (paragraph 8.7.4) and the Main PCBA (paragraph 8.7.5). Remove the control panel cover by unlatching the cover and pulling it straight forward from the hinges. Remove the control knobs (6 pcs., Item #20 on Figure 9.4.1). Discard the entire top half assembly.

Replace the control knobs on the new top half assembly (Item 18 in Table 9.4, Replacement Parts List). Reinstall the control panel cover and reassemble the ventilator following instructions in paragraphs 8.7.5, 8.7.4 and 8.7.1.

8.8 Pressure Transducer Calibration

CAUTION

The calibration accuracy of all test equipment used to test and calibrate the Bird Avian should be verified before recalibrating the ventilator.

Disassemble the case as described in paragraph 8.7.1 above. Locate the DIP switch SW-1 and place it in the On position. Reconnect external or battery power to the Avian. Connect a 40 - 60 psig medical grade air/O_2 source to the ventilator and turn the Flow control full counter clockwise (CCW). Turn the Mode switch in any position except Off. The Monitor Display will alternately flash PCAL and 0. Press and hold the P_{aw} display switch for three seconds. The Monitor Display will alternately flash PCAL and 50. Apply a known (calibrated) pressure of 50 cmH_2O to the Proximal Pressure port on the Avian. Press and hold the P_{aw} display switch for three seconds. The Monitor Display will display FCAL. Remove the pressure source from the Proximal Pressure port. Press and hold the Flow display switch for three seconds. The Monitor Display will alternately flash PCAL and 0. Turn the Mode switch to the Off position and return the DIP SW-1 to the Off position.

Perform an operational test of the ventilator (paragraph 4.3) before reassembling the unit. Recalibrate the unit again if the Avian does not pass the functional test.

Disconnect the pneumatic and power sources from the ventilator and reassemble the unit following the instructions in paragraph 8.7.1.

8.9 Error Codes

The Avian will display error codes when certain failures occur. While these codes are intended to facilitate board level repairs, the codes are provided as reference information in this section of the manual.

Error Code	Meaning
3	The PAL is in reset.
4	The PAL has detected a single error.
5	The PAL has detected a double error.
10	Pass 1, Bit B of Byte SP is set when it should not be.
11	Pass 1, the read/verify failed at Byte R0
12	Pass 1, Byte B of Byte @SP is at zero when it should not be.
13	Pass 1, read/verify failed at Byte R0.
20	The Mode Switch has more than one switch closed.
21	The Assist Switch has more than on switch closed.
30	The A to D count is 255 indicating a potentiometer overrange.

Error Code	Meaning
31	The 2.5 volt system reference is out of range.
32	The internal A to D reference is out of range.
40	EPROM checksum failed at power up.
41	EPROM checksum failed during run time.
50	The 4ms software watchdog failed.
51	There is a software branch to address 0202H
60	An error occurred at power up when reading the Factory Cal Zero from the EPROM.
61	An error occurred at power up when reading the Factory Cal Span from the EPROM.
62	An error occurred at power up when reading the User Cal Zero from the EPROM.
63	An error occurred at power up when reading the Factory Cal Flow from the EPROM.
70	An error occurred in writing the EPROM non-volatile RAM.

8.10 Technical Assistance

Technical assistance for this product can be obtained by contacting the Bird Products Corporation:

Technical Services Department
1100 Bird Center Drive
Palm Springs, CA 92262
(619) 778-7200 or (800) 328-4139
FAX: (619) 778-7269

SECTION 9.0
Schematics and Illustrated Parts Listings

9.1 Introduction

Included in this section are the following schematics, drawings and lists:

- List of Accessories, 9.3
- Accessories Illustration, Figure 9.3.1
- List of Replacement Parts, 9.4
- Illustrated Part Drawing, Figure 9.4.1
- Main Printed Circuit Board Illustration, Figure 9.5
- Main Printed Circuit Board Schematics, Figures 9.5.1 - 9.5.6
- Display Printed Circuit Board Illustration, Figure 9.6
- Display Printed Circuit Board Schematic, Figure 9.6.1
- Power Supply Printed Circuit Board Illustration, Figure 9.7
- Power Supply Printed Circuit Board Schematic, Figure 9.7.1

9.2 Parts and Accessories Ordering Information

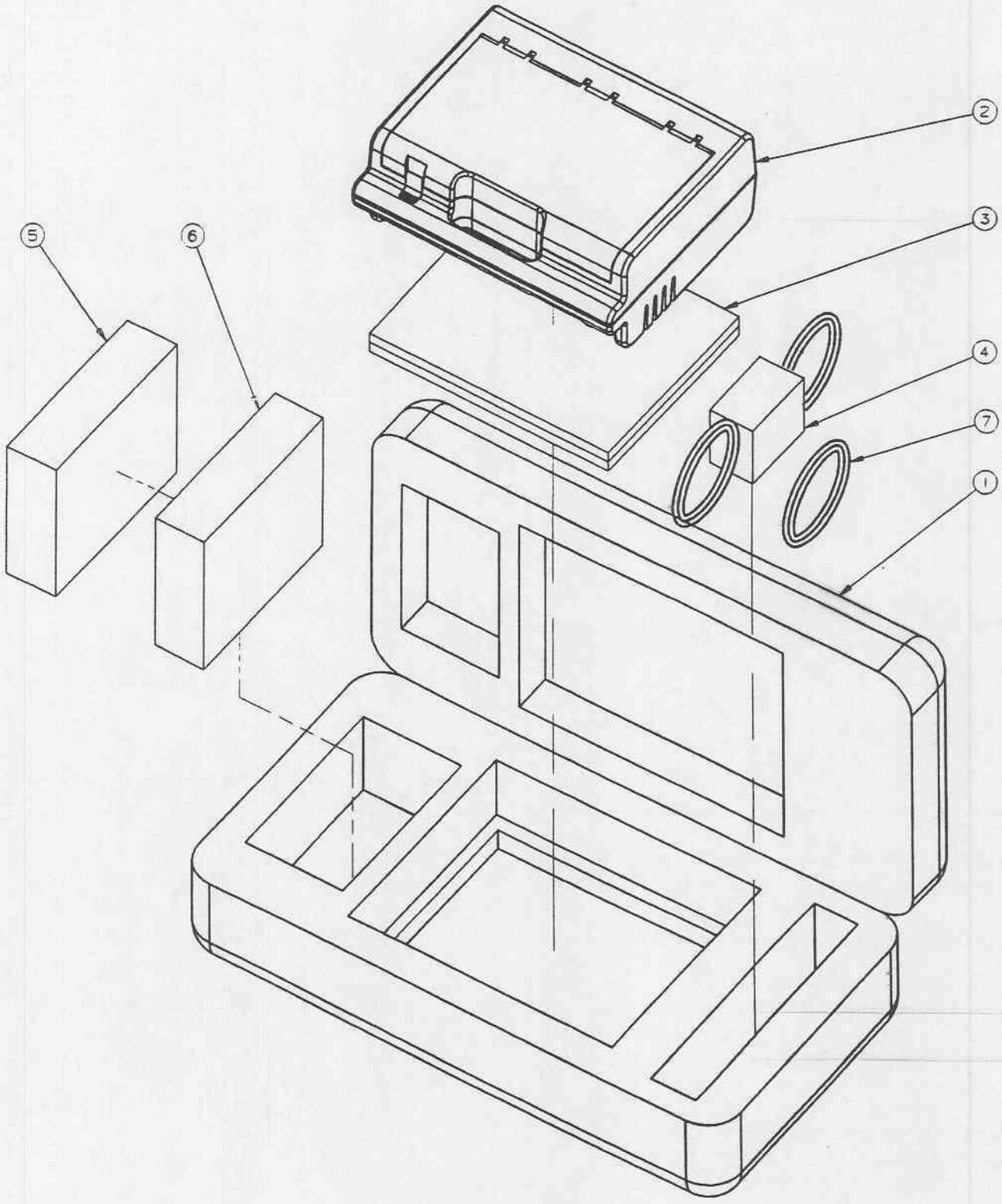
Contact Bird Products Corporation:

Customer Service Department
1100 Bird Center Drive
Palm Springs, CA 92262
(619) 778-7200 or (800) 328-4139
FAX: (619) 778-7274

9.3 List of Accessories

REF NO.	ITEM DESCRIPTION	PART NUMBER
1	Case, Carrying	10290
2	AVIAN Ventilator	15300
3	Manual, Operations/Service	L1248
4	Power Supply, Avian	68078
5	Kit, Patient Circuit	15289
6	Hose Assembly, O_2	10293
7	Cord, DC Input, 6 Ft. Long	15288

Figure 9.3.1 Accessories Illustration



9.4 Replacement Parts List

REF NO.	ITEM DESCRIPTION	PART NUMBER
1	Screw, 6-32 X .250 (4 ea.)	04381
2	Label, Instruction	80113
3	Cover, Battery	20523
4	Gasket, EMI/O-Strip	33685
5	Battery, Rechargeable, 12V	68106
6	Bumper, .50 Diameter X .14 High	33688
7	Case, Base (bottom half of case)	20496
8	Label, Battery Instructions	80109
9	Screw, 6-32 X 1.312 (1 ea.)	40088
10	Printed Circuit Board, Main	50370
11	Screw, 6-32 X .50 (4 ea.)	08434
12	Printed Circuit Board, Display	50380
13	Case, Lid (top half of case)	20497
14	Screw, Machine, 6-32 X .25 (7 ea.)	40085
15	Plate, Latch	20518
16	Spring, .110ID X .20 X .30L	03286
17	Latch	20519
18	Overlay/Switch Panel Assembly (Includes Item 13)	10316
20	Knob, Control (s)	20238
21	Case, Cover (control panel cover)	20498
22	Panel, Manifold, Avian	20499
23	Printed Circuit Board, Power Supply	50390
24	Connector, DISS O_2, 1/4" tube	20227
26	O-Ring, .239 X .070	05307
27	O-Ring, .739 X .070	05327
28	Pneumatic Manifold Assembly (Includes Items 14 (3 ea.), 22,24,26,27,29,30,33,34)	15301
29	Solenoid Assembly, Flow Valve	15303
30	Solenoid Assembly, Demand Valve	15309
31	Screw, 10-32 X 2.25 Hex Cap (1 ea.)	03826
33	Screw, 6-32 X 2.0 (4 ea.)	40084
34	Regulator, Pressure	33682
35	Screw, Machine, 10-32 X .375 (5 ea.)	40082
36	Muffler, Bleed	20529
37	Ring, Int, .39	47011
38	Cable Assembly, Power Supply	15292
39	Connector, 1/8" Tube Tee	00358
40	Tube, 1/8 ID Silicon (Proximal Pressure Line)	04029
41	Tube, 1/8 ID Silicon (Solenoid Valve Bleed Lines)	04029
42	Cable Assembly, Battery	15293
Fig 9.5	EPROM	15305
Fig 9.7	Fuse, 1 Amp/250V, Timelag	09510

Figure 9.4.1 Illustrated Parts Drawing (Exploded View)

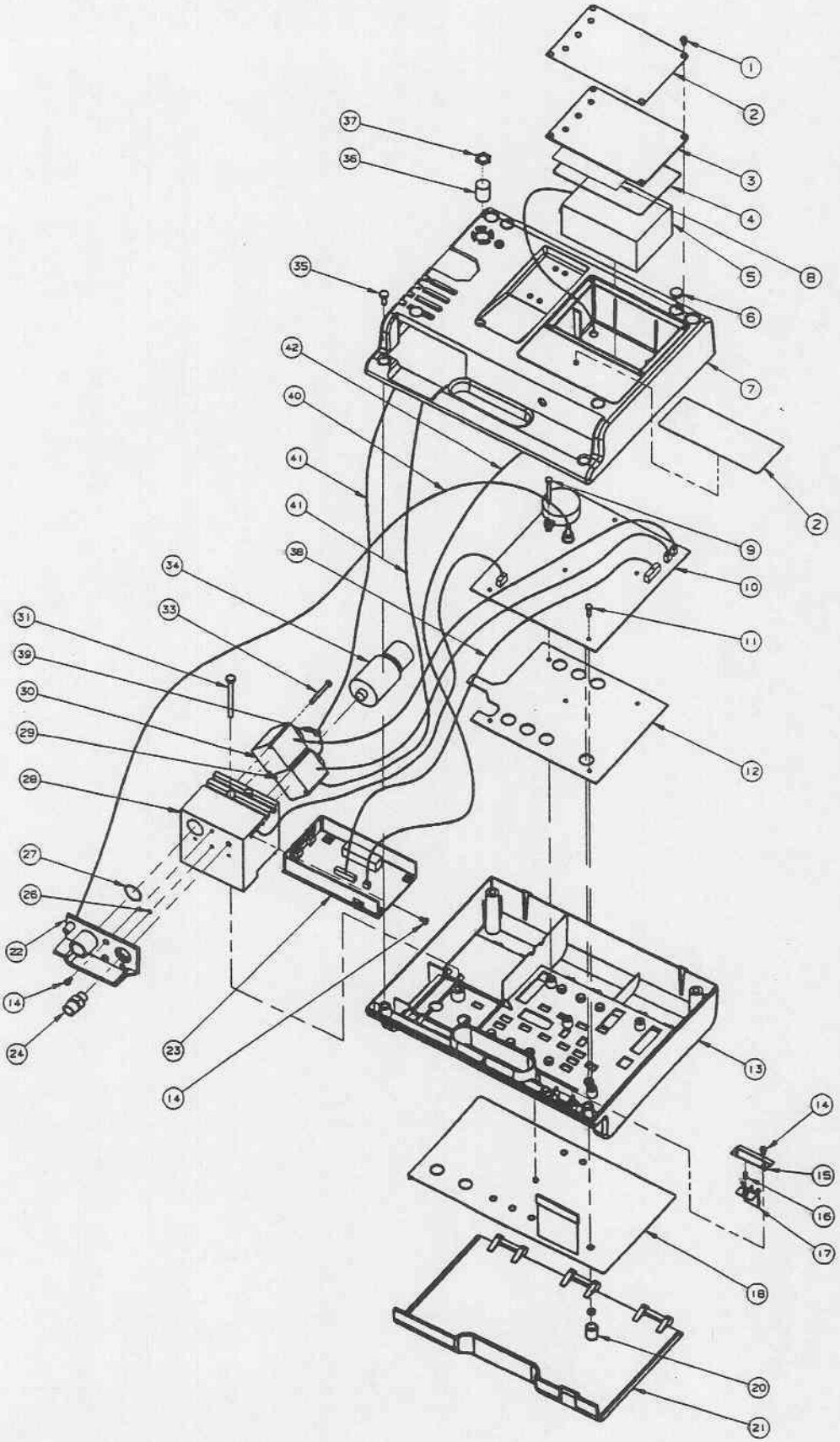


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Figure 9.5 Main Printed Circuit Board Illustration (Part Number 50370)

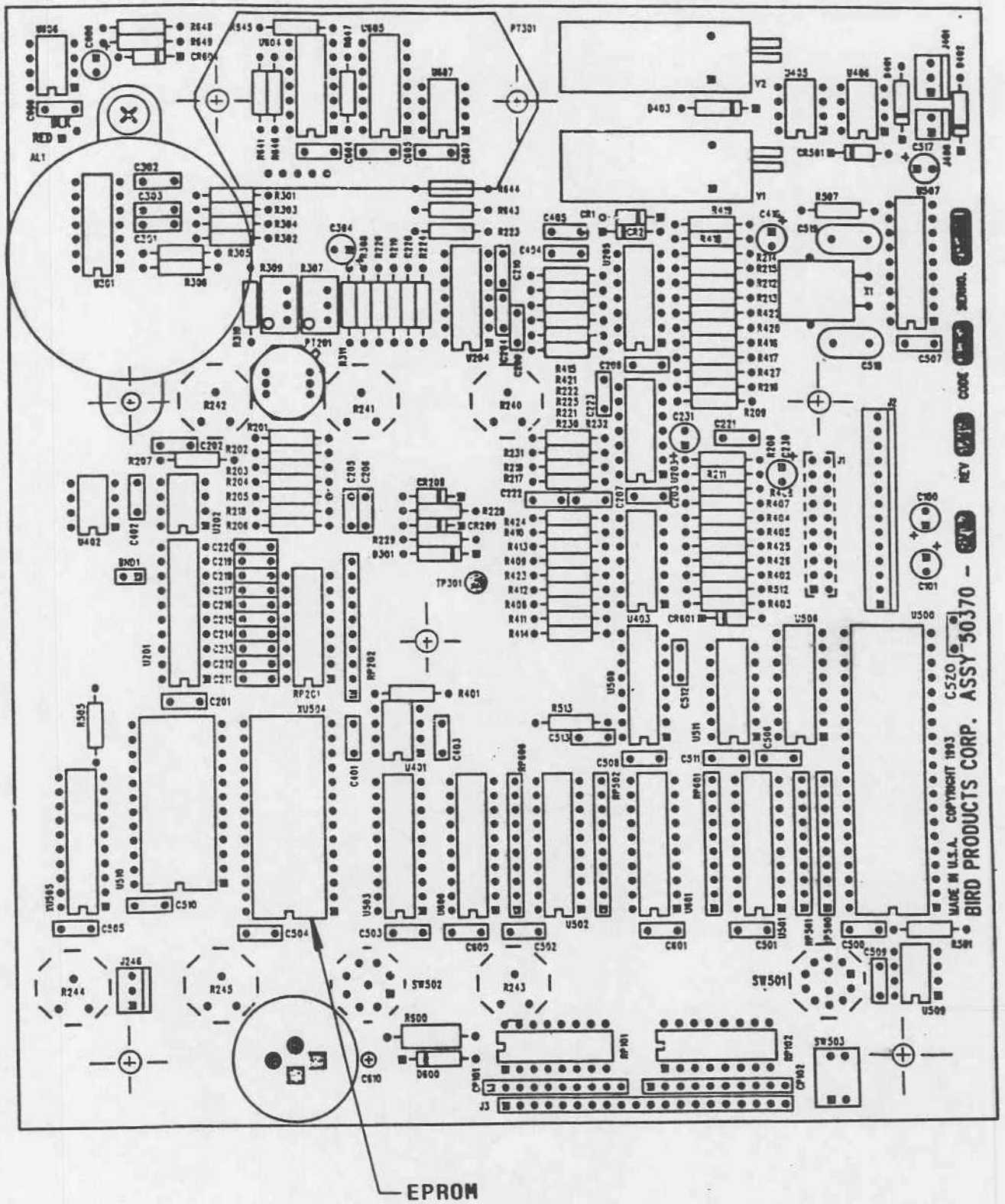

Figure 9.6 Display Printed Circuit Board Illustration (Part Number 50380)

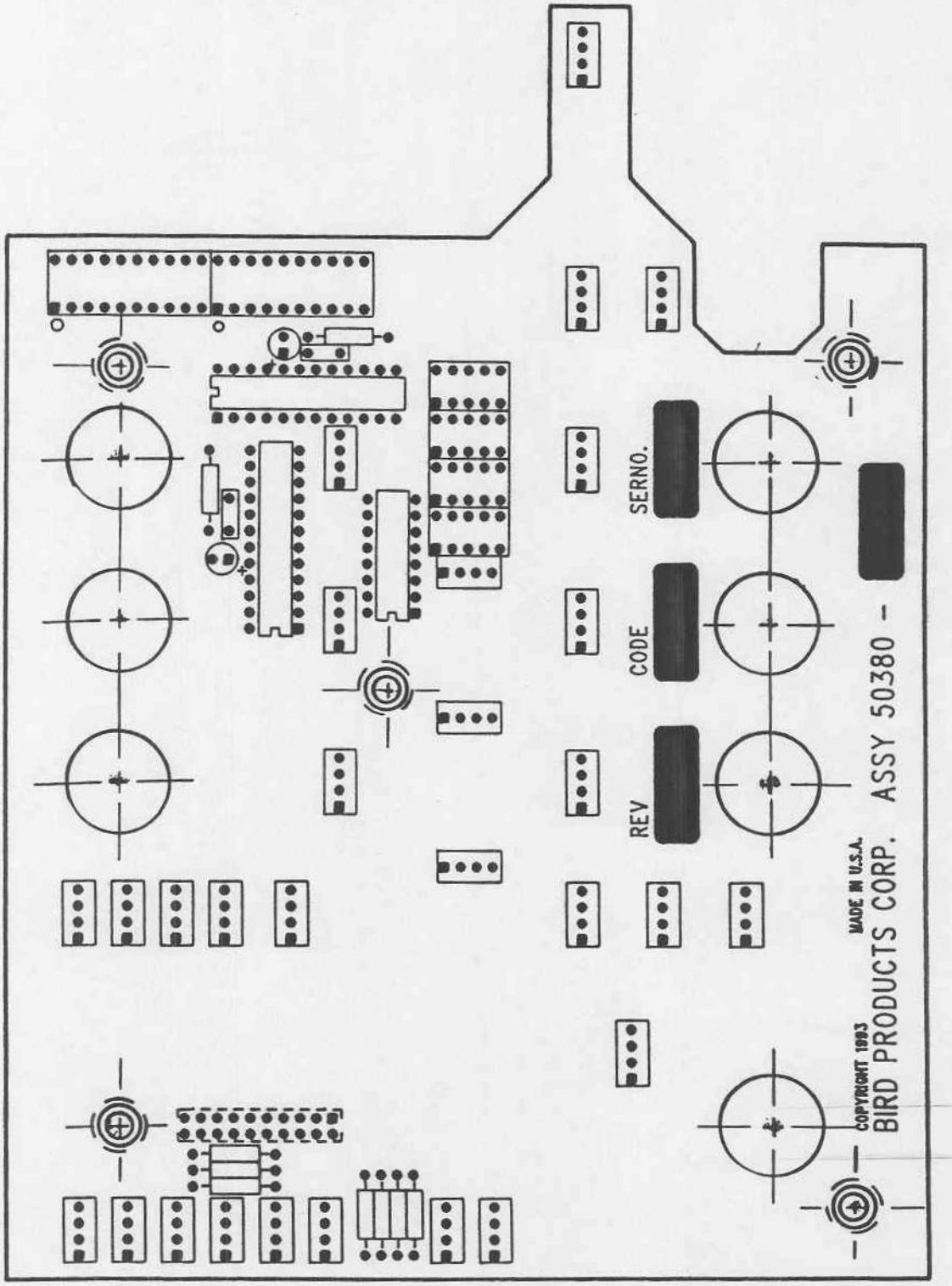

Figure 9.7 Power Supply Printed Circuit Board Illustration (Part Number 50390)

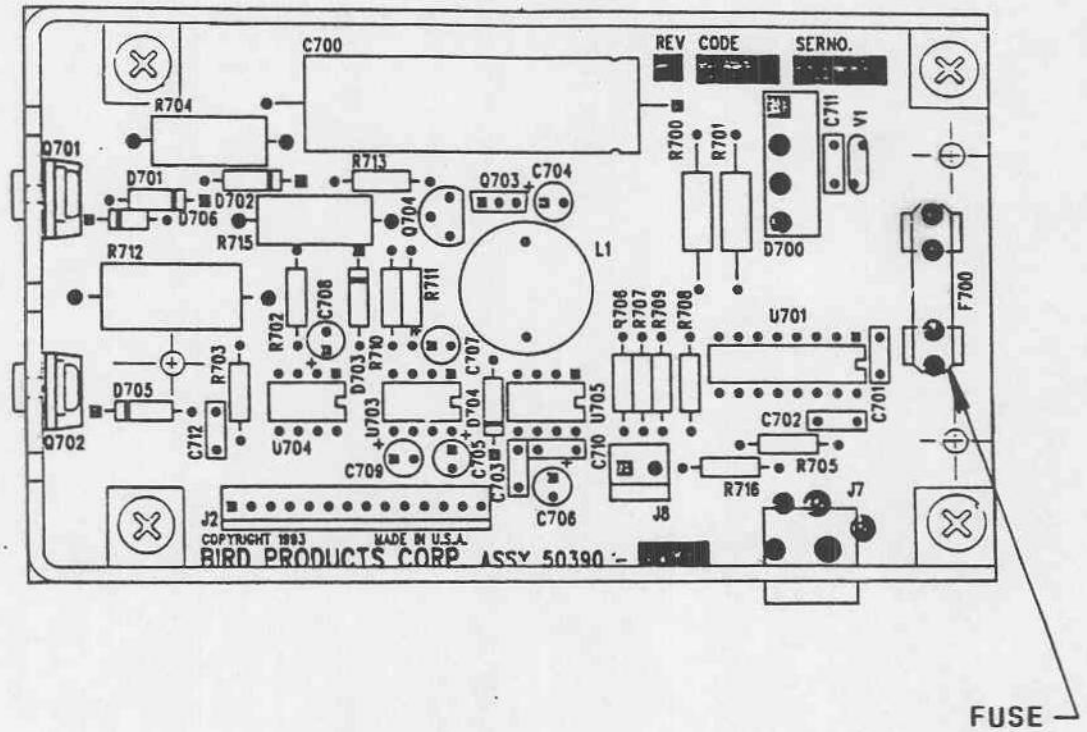

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Figure 9.5.1 Main Printed Circuit Board Schematic, Sheet 1 of 6

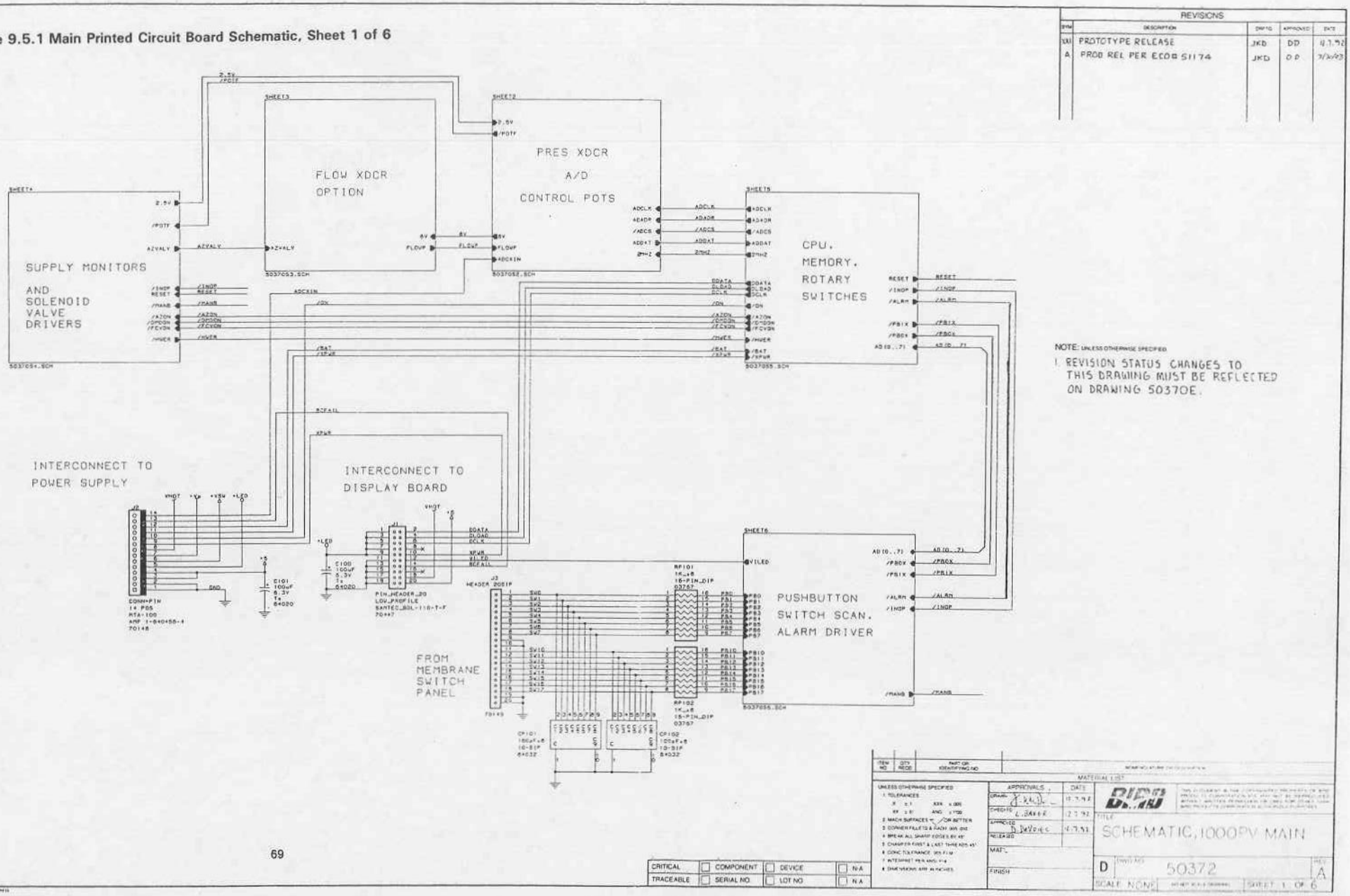
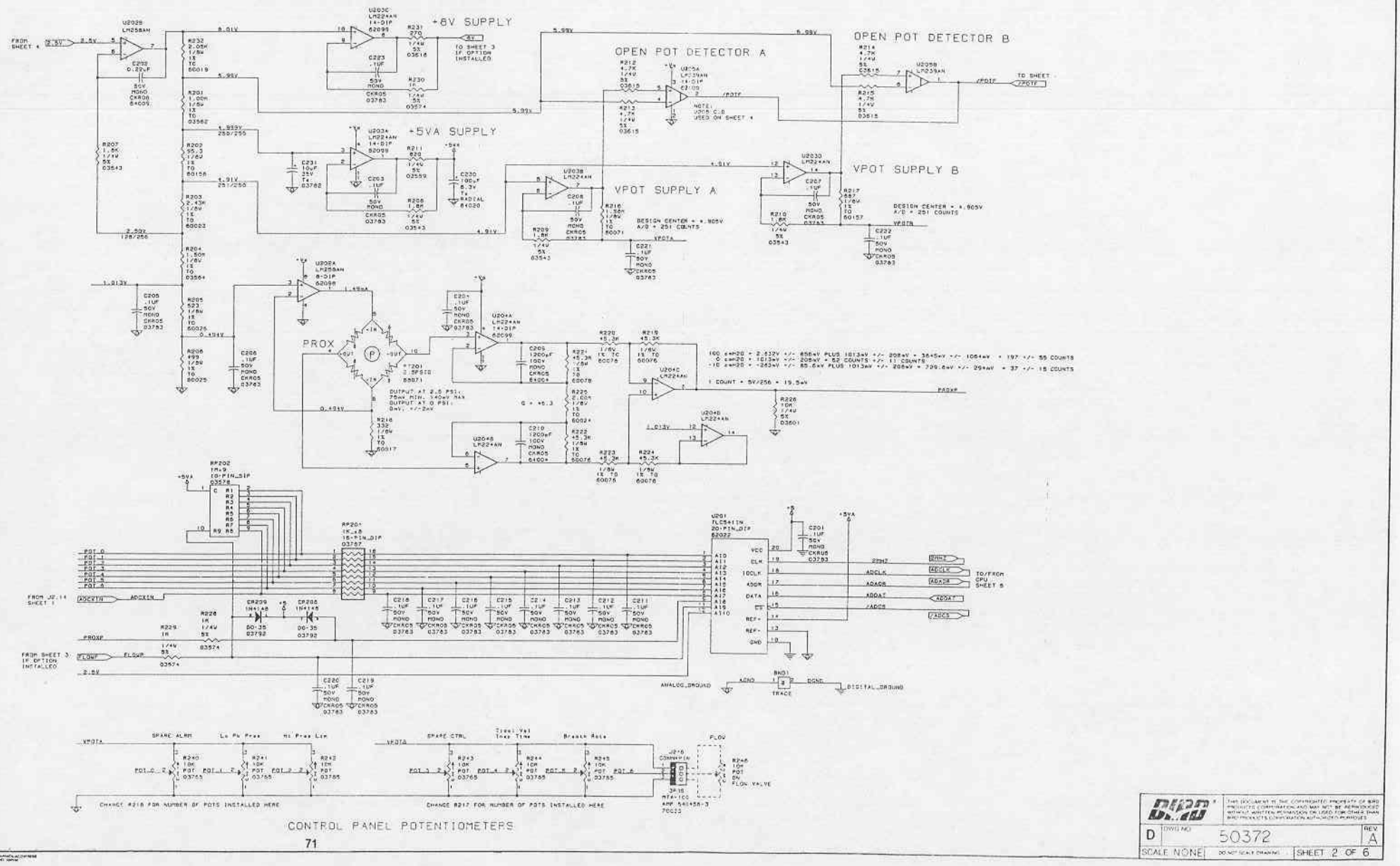


Figure 9.5.2 Main Printed Circuit Board Schematic, Sheet 2 of 6



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D	DWG NO 50372	REV A
SCALE NONE	DO NOT SCALE DRAWING	SHEET 2 OF 6

Figure 9.5.3 Main Printed Circuit Board Schematic, Sheet 3 of 6

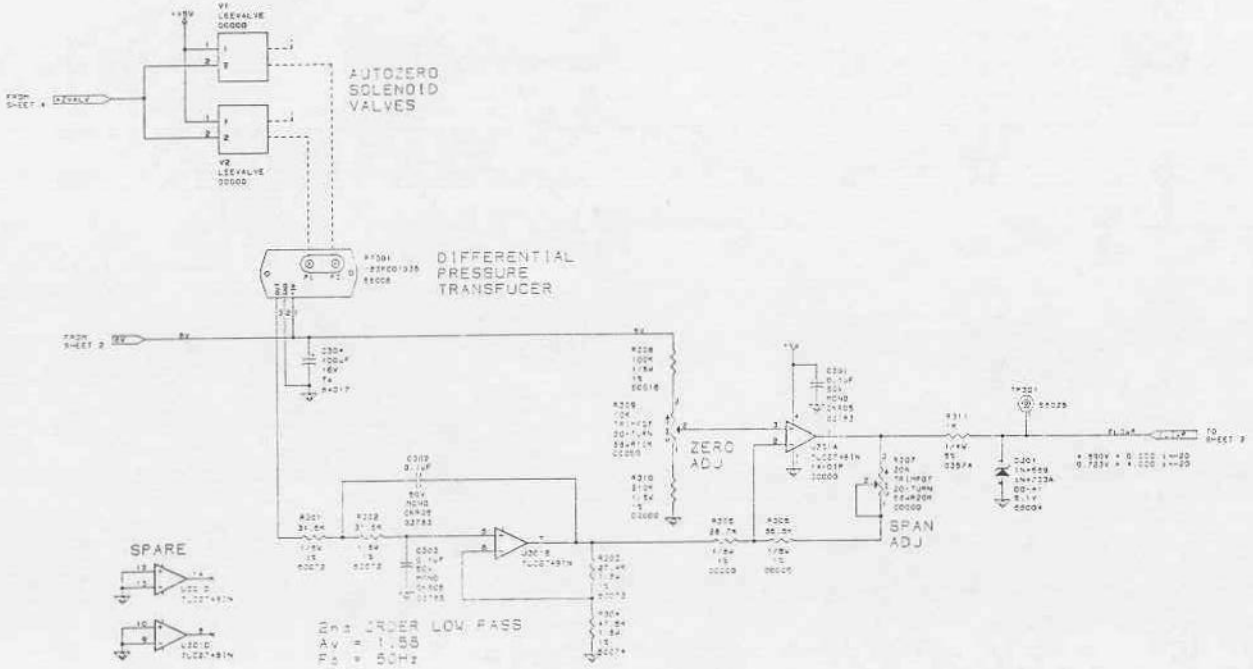

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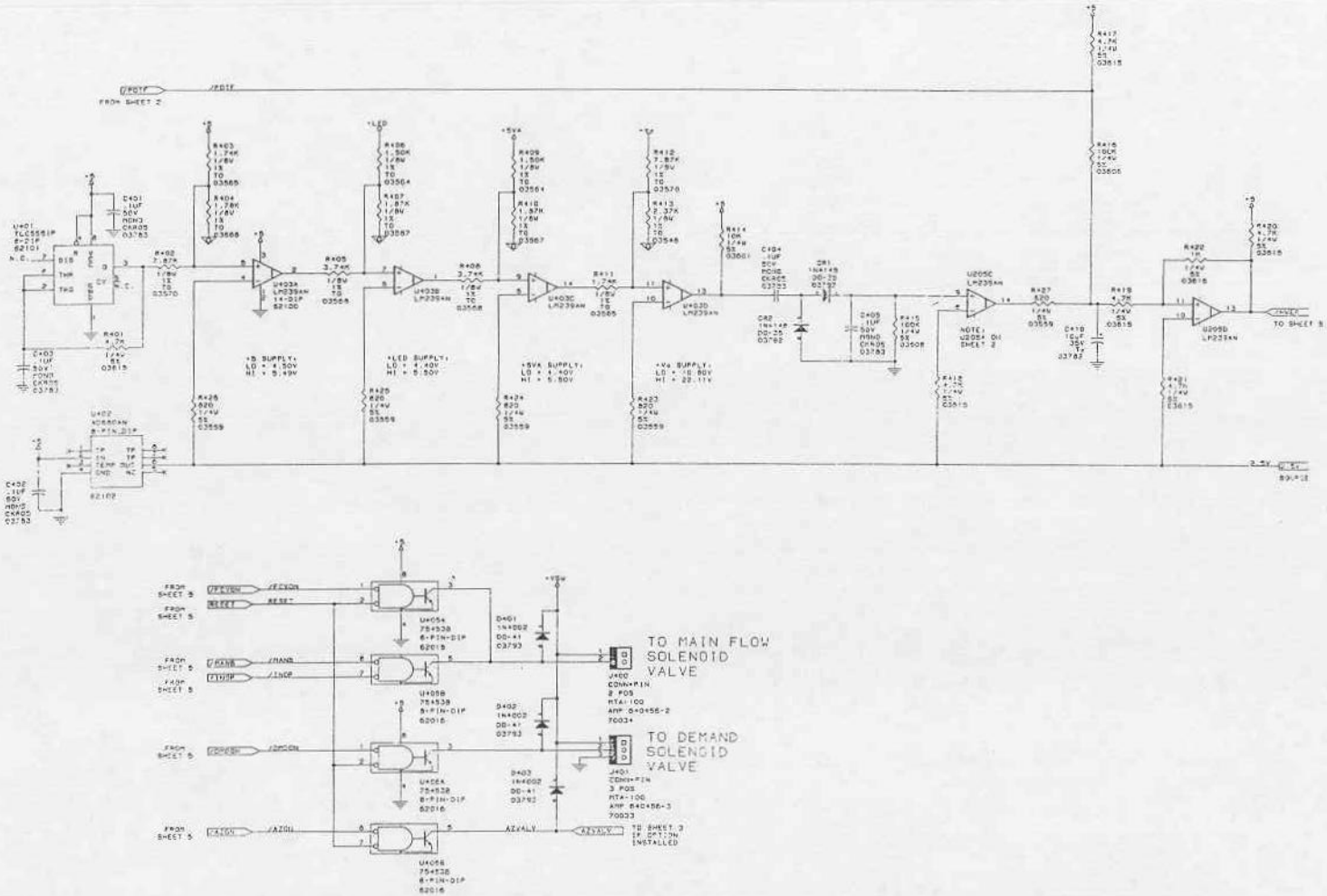
Figure 9.5.4 Main Printed Circuit Board Schematic, Sheet 4 of 6



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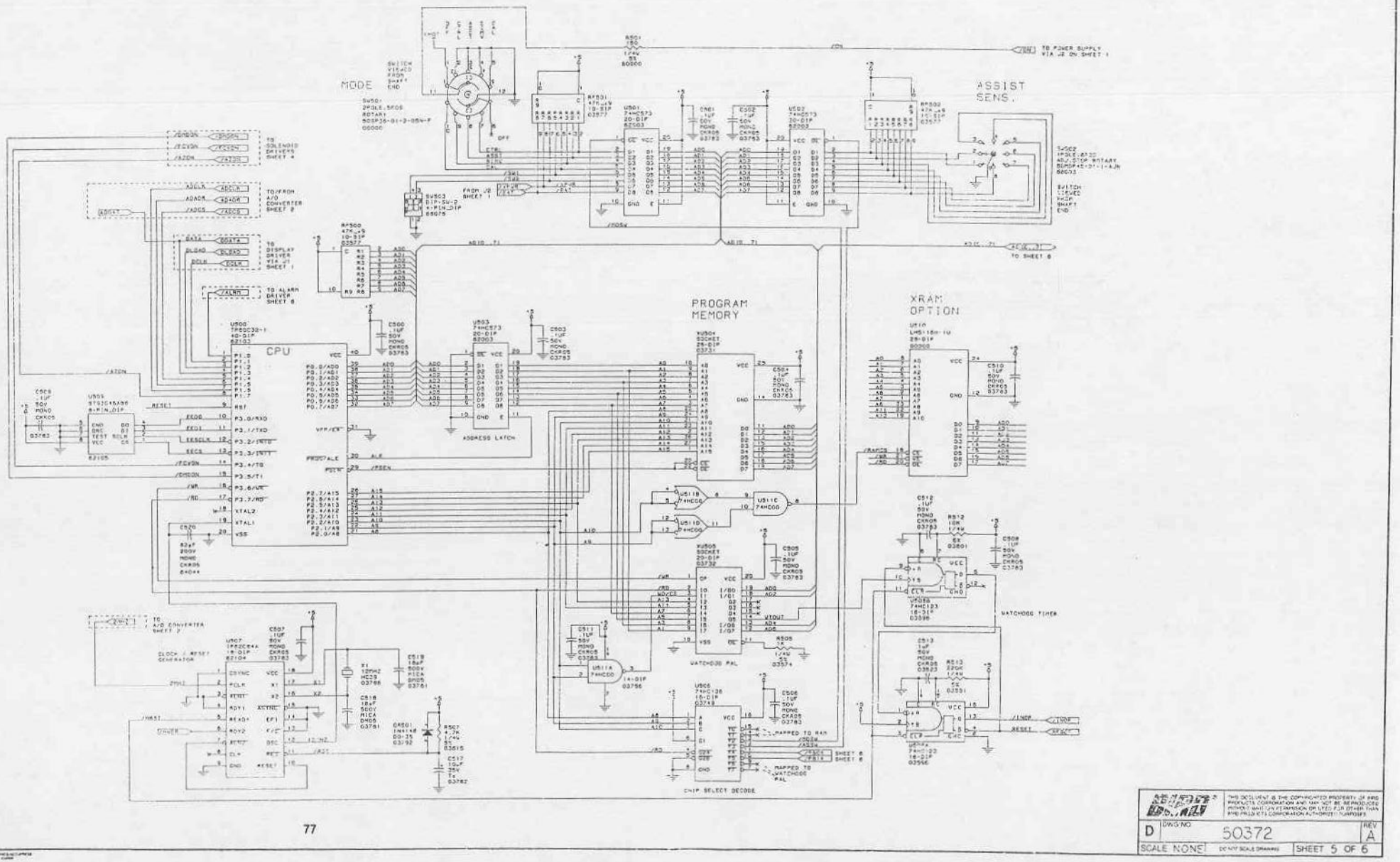
SCALE NONE	DO NOT SCALE DRAWING	SHEET 4 OF 6

Figure 9.5.5 Main Printed Circuit Board Schematic, Sheet 5 of 6



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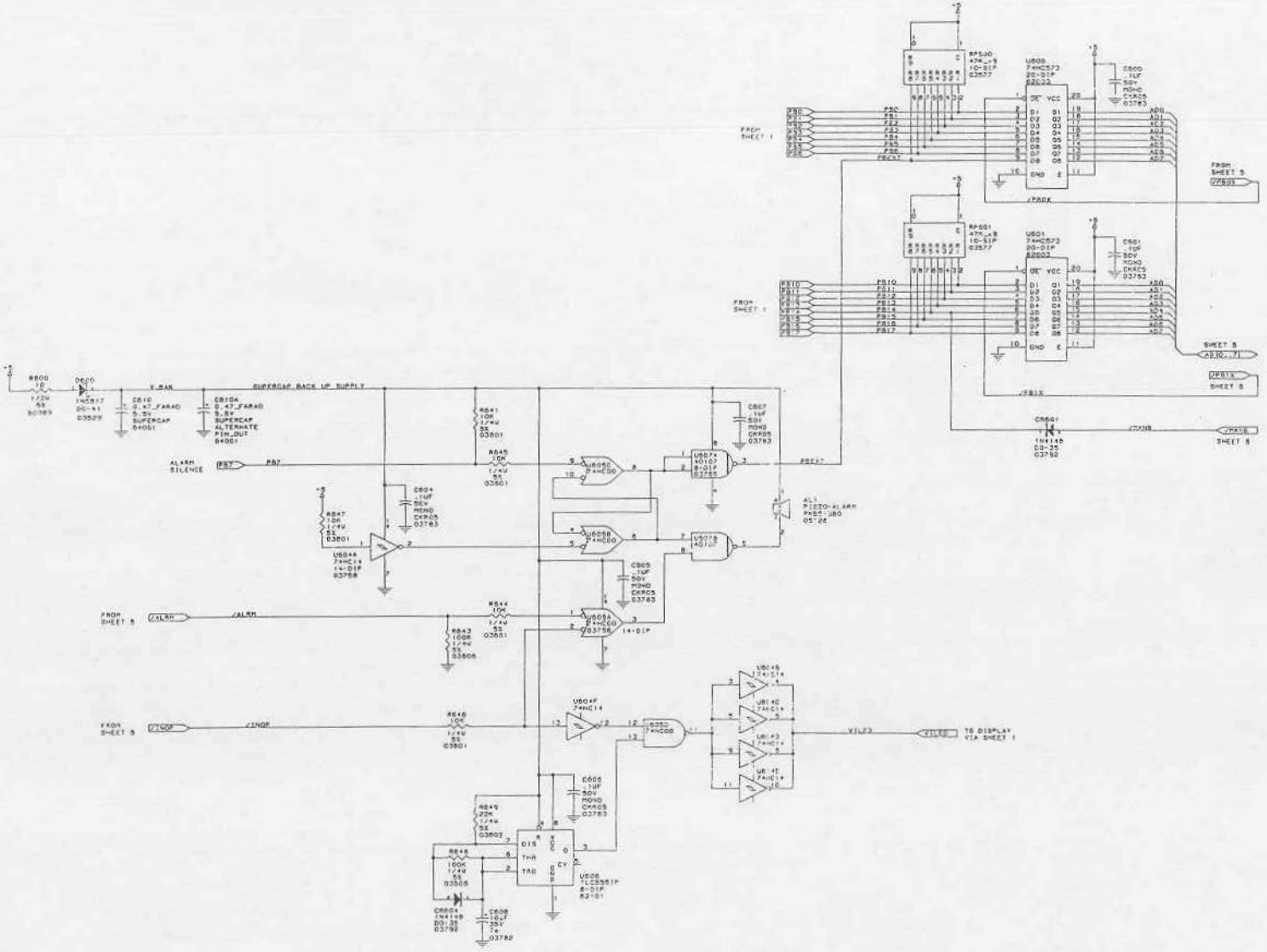
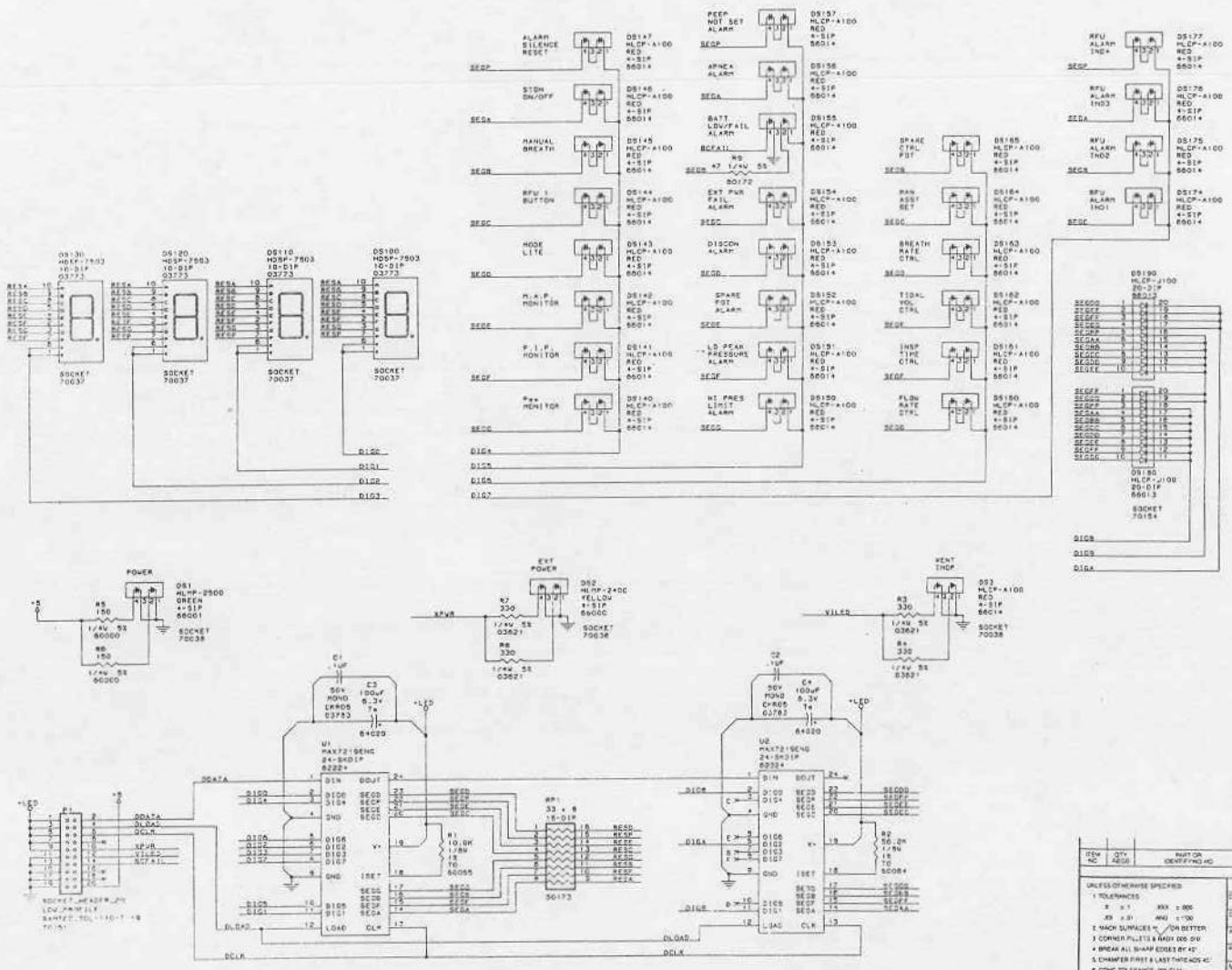
SCALE NONE	DO NOT SCALE DRAWING	SHEET 5 OF 6

Figure 9.5.6 Main Printed Circuit Board Schematic, Sheet 6 of 6



D	DWG NO. 50372	REV A
SCALE NONE	DO NOT SCALE DRAWING	SHEET 6 OF 6

Figure 9.6.1 Display Printed Circuit Board Schematic



REVISIONS				
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X1	PROTOTYPE RELEASE	JKD	DD	11.17.92
B	PILOT REL PER ECO # 50893	JKD		
A	PROD REL PER ECO # 51183	JKD	D D	3/24/93

NOTE: UNLESS OTHERWISE SPECIFIED

1. REVISION STATUS CHANGES TO THIS DRAWING MUST BE REFLECTED ON DRAWING 50380E

ITEM NO.	QTY. REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
		MATERIAL LIST	

UNLESS OTHERWISE SPECIFIED:
1. TOLERANCES
2. MACH SURFACES ___ OR BETTER
3. CORNER FILLETS & RADII .005 .010
4. BREAK ALL SHARP EDGES BY .XX
5. CHAMFER FIRST & LAST THREADS
6. CONC TOLERANCE .005 F.I.M.
7. INTERPRET PER ANSI Y14
8. DIMENSIONS ARE IN INCHES

APPROVALS	DATE
DRAWN L.ALDX	11.16.92
CHECKED L.BAKER	11.17.92
APPROVED D.DEVRIES	11.17.92
RELEASED	
MAT'L	
FINISH	

NELLCOR PURITAN BENNETT

TITLE: SCHEMATIC, 1000PV DISPLAY

SIZE	DWG NO.	REV
D	50382	A

SCALE: NONE | SHEET 1 OF 1

CRITICAL	COMPONENT	DEVICE	N/A
TRACEABLE	SERIAL NO.	LOT NO.	N/A

Figure 9.7.1 Power Supply Printed Circuit Board Schematic

REVISIONS				
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X2	PROTOTYPE RELEASE			
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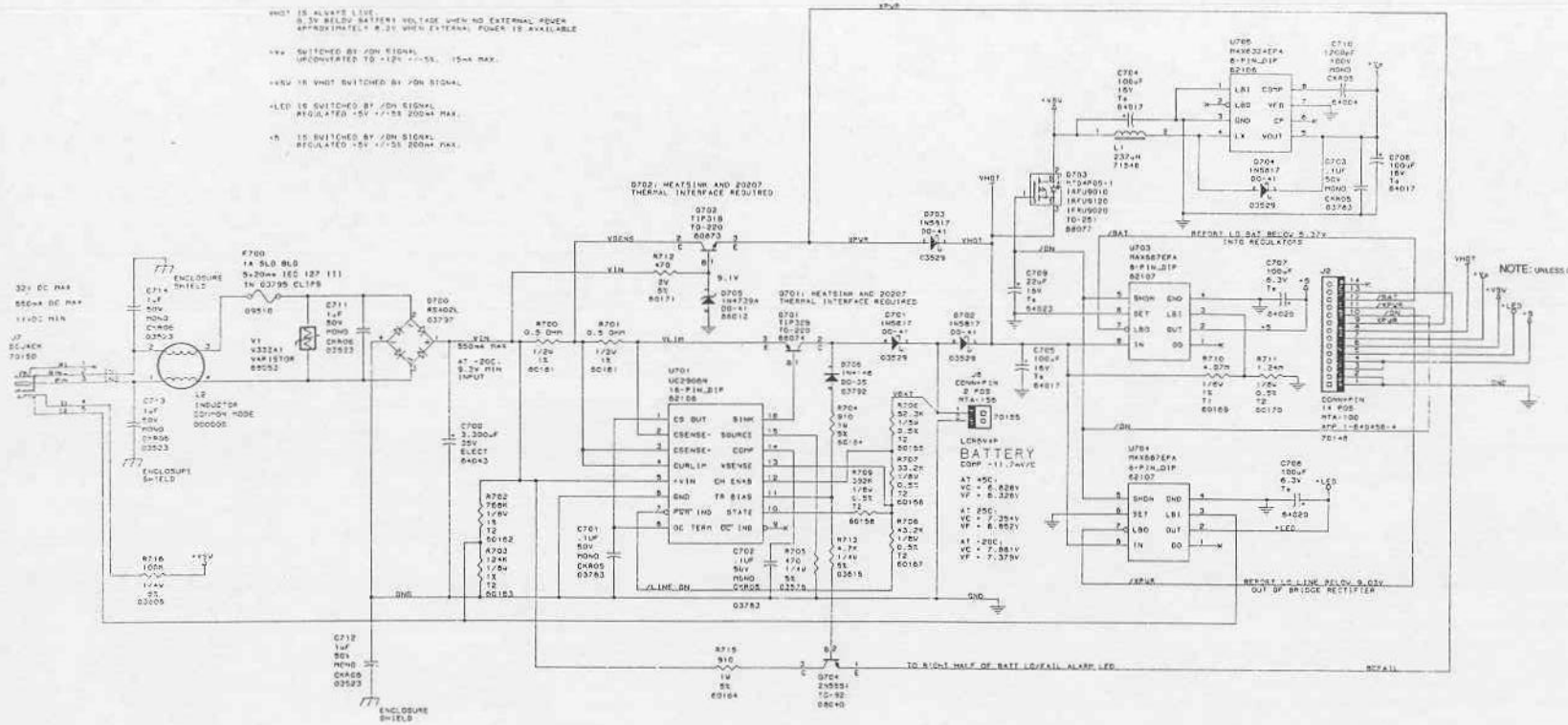
A	PROD REL PER ECO # 51170		D.D.	11/4/93


VHOT IS ALWAYS LIVE
+5V SWITCHED BY /ON SIGNAL
+LED IS SWITCHED BY /ON SIGNAL
+5 IS SWITCHED BY /ON SIGNAL
U705 MAX632AEPA
U703 MAX687EPA
U704 MAX687EPA
U701 UC2906N
L1 237µH
F700 1A SLO BLO
J7 DC JACK
J8 CONN-PIN 2 POS
J2 CONN-PIN 14 POS
BATTERY
NOTE: UNLESS OTHERWISE SPECIFIED
1. REVISION STATUS CHANGES TO THIS DRAWING MUST BE REFLECTED ON DRAWING 50390E.

MATERIAL LIST			
ITEM NO	QTY REQD	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION

UNLESS OTHERWISE SPECIFIED
1. TOLERANCES
2. MACH SURFACES 63 OR BETTER
3. CORNER FILLETS & RADII .005-.015
4. BREAK ALL SHARP EDGES BY 45°
5. CHAMFER FIRST & LAST THREADS 45°
6. CONC TOLERANCE .005 F.I.M.
7. INTERPRET PER ANSI Y14.5
8. DIMENSIONS ARE IN INCHES

APPROVALS		DATE
DESIGN	L. BAYER	11.19.92
CHECKED	J. K. DACK	11.20.92
APPROVED	D. DeVRIES	11.20.92
RELEASED		
MAT'L		
FINISH		

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TITLE: SCHEMATIC, 1000PV POWER

D | DWG NO 50392 | REV A

SCALE NONE | DO NOT SCALE DRAWING | SHEET 1 OF 1

CRITICAL	COMPONENT	DEVICE	N/A
TRACEABLE	SERIAL NO.	LOT NO.	N/A